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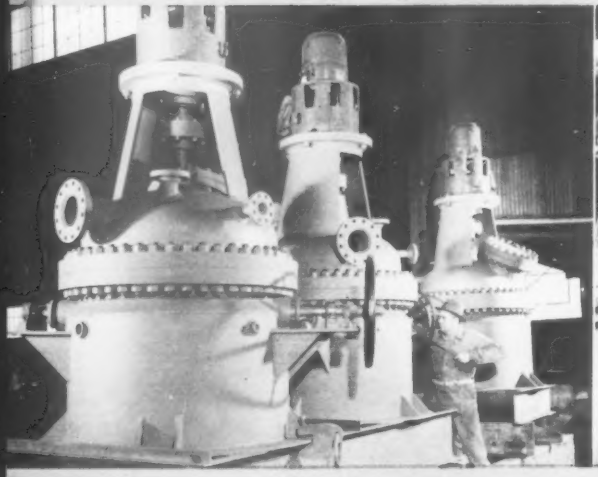

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NEXT WEEK

- New Unit Really Cleans Tube Bundles.
- Petrochem Report: Neches Butane Products Co. and Gulf Oil Corp.
- Direct Determination of Bottom-Hole Pressures.
- Drill-Pipe Rejects Show Good Service Life.
- How to Join Different Sizes of Pipe at Odd Angles.
- Oakford Project Dehydration Plant.
- Automatic Tank-Gaging Facilities.
- Radioisotope Tracer Successful in Products Pipe Line.
- Automatic Flash-Point Instrument.

REGULAR DEPARTMENTS

They Say	53
Calendar of Events	54
Journally Speaking	59
Editorial	61
This Week	63
Watching Washington	76
International News	80
Personals	85
Deaths in the Industry	87
Books	112-116
On the Job	125
Engineering Reference	129
Modern Drilling	131
Heat Transfer	132
Refiner's Notebook	133
Engineering Fundamentals	135
Progress in Metals	136
Pipe-Line Construction	137
Pipe-Line News	144
Natural-Gas News	147
Natural-Gasoline News	147
Refining News	148
Drilling Contractors	150
Active Rotary Rigs	150
Exploration Statistics	168
Production Statistics	169
Refining Statistics	170
Market Statistics	171
Equipment Men in News	175
Classified Advertising	178
Advertisers' Index	181

EXPLORATION—DEVELOPMENT

Williston Sketches	153
Highlights of Week	153
Reports by Areas	154

CONTENTS FOR NOVEMBER 3, 1952

NEWS FEATURES

CO_2 Solution in Flooding Brings Higher Oil Yields, Group Told	64
Electric Current Through Oil Sands May Raise Production	64
Reservoir Types Determine Success or Failure of Wetting Agents	65
Economics of Dehydration Processes Discussed by N.G.A.A. Panel	66
Oil Discovery Indicated by Deep Test in Delaware Basin	66
Proration Dilemma Facing Texas and New Mexico	67
Northern Natural's Growing Pains Typical of Industry's Problems	69
U. S. Can Produce Enough Oil to Meet Needs Without Imports, I.P.A. Says	70
United States Pipe Line Co.'s Project Partially Amortized	71
Gas-Utility Industry Warned to Promote Product, Continue Research	72
Added Gas Research Is Needed, A.G.A. Told	73
Westby Accepts as Head of I.P.E. Selection Committee	74
Benzene Market to Remain, But Substitutes May Curtail Demand	74
Companies Ask Supreme Court to Review Rulings in Cartel Case	75
Alkylate Output Up to 10,000 Bbl. Daily	76
Oil-Country Tubular Goods Allocated for First-Quarter Operations	76
NPA Takes Over Control of Tubular Goods Made From Imported Steel	76
Socony Sets Up New Exploration, Production Division at Casper	79
Fabulous Gas System Proposed From Iraq Fields to Paris	80
Workers, Employers Divided on Cut in Work Hours; Study Asked	83

ENGINEERING-OPERATING FEATURES

Southern Natural Removes Distillate From Pipe Lines — 88
Pipe-line efficiency is increased by injecting absorption oil into field lines. By L. N. Brown and J. M. Phillips, Southern Natural Gas Co.

New Procedures in Industrial Thermal-Insulation Application — 90
New application techniques, development and prefabricated shapes drastically reduce installed cost of insulation. By C. J. Kuhasz and E. C. Shuman.

Low-Temperature Insulation for Refinery Service — 99
High cost of obtaining and maintaining low temperatures demands best of insulation practices. By W. L. Martin, Humble Oil & Refining Co.

Water Flooding in Kansas' Golden Lane — 104
Performance data and field report on 52 water-flood projects in Greenwood County, Kansas.

How to Cope With Crooked-Hole Problems — 111
Large drill collars, two-cone bits, and stabilized drill-collar strings used to straighten hole. By Gerald Burgess, Ohio Oil Co.

Where Will Tomorrow's Oil Come From — 119
Yet-to-be-discovered deposits of oil should meet world's petroleum needs for long time to come. By E. V. Murphree, Standard Oil Development Co.

On the Job . . . In the Plants — 125
Tennessee Natural's control of outlet regulators.

On the Job . . . In the Fields — 126
Connecting into a full line.

Engineering Reference Section	129
Modern Drilling	131
Heat Transfer	132
Refiner's Notebook	133
Engineering Fundamentals	135
Progress in Metals	136

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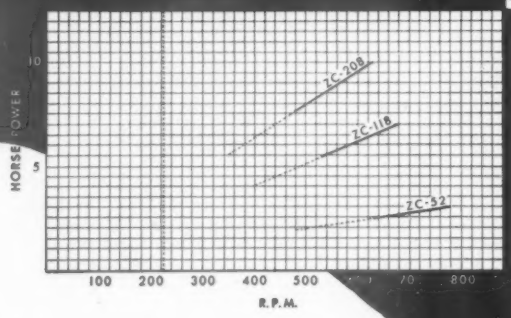

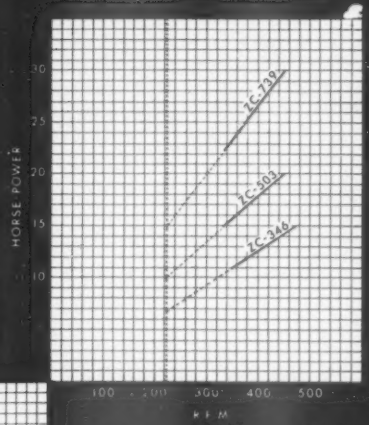

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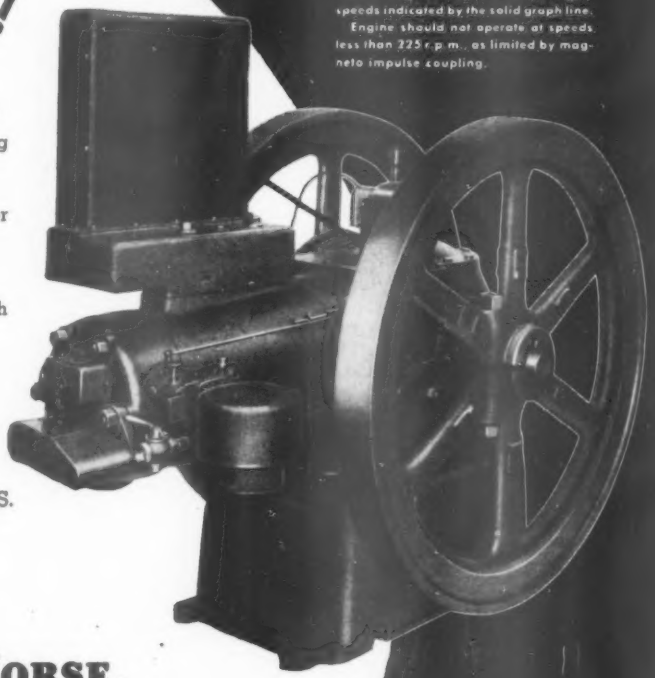

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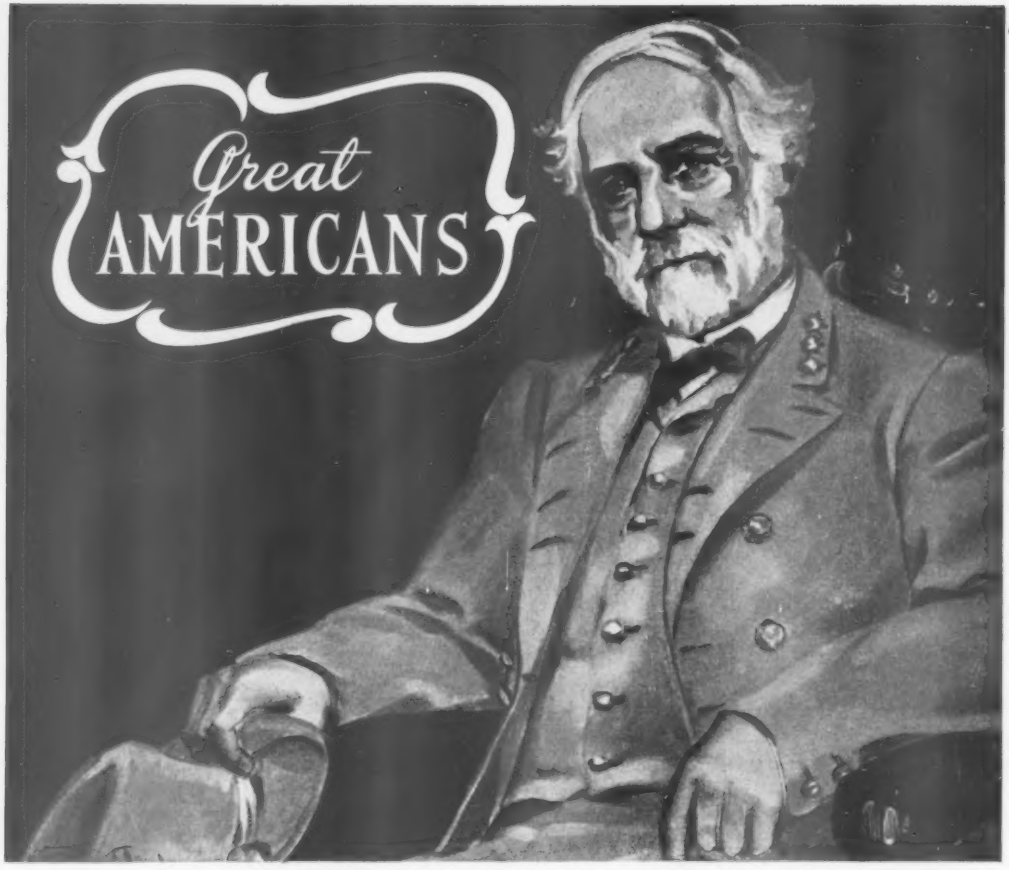

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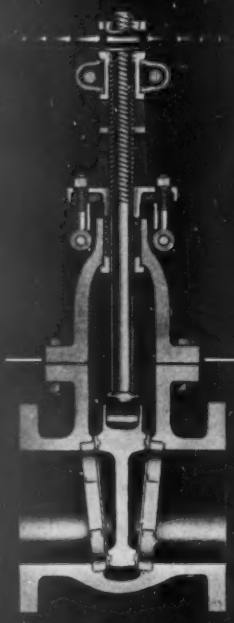

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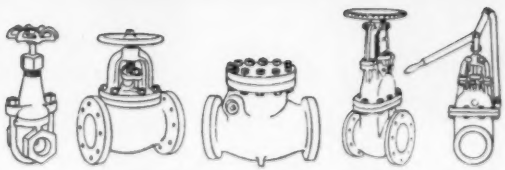

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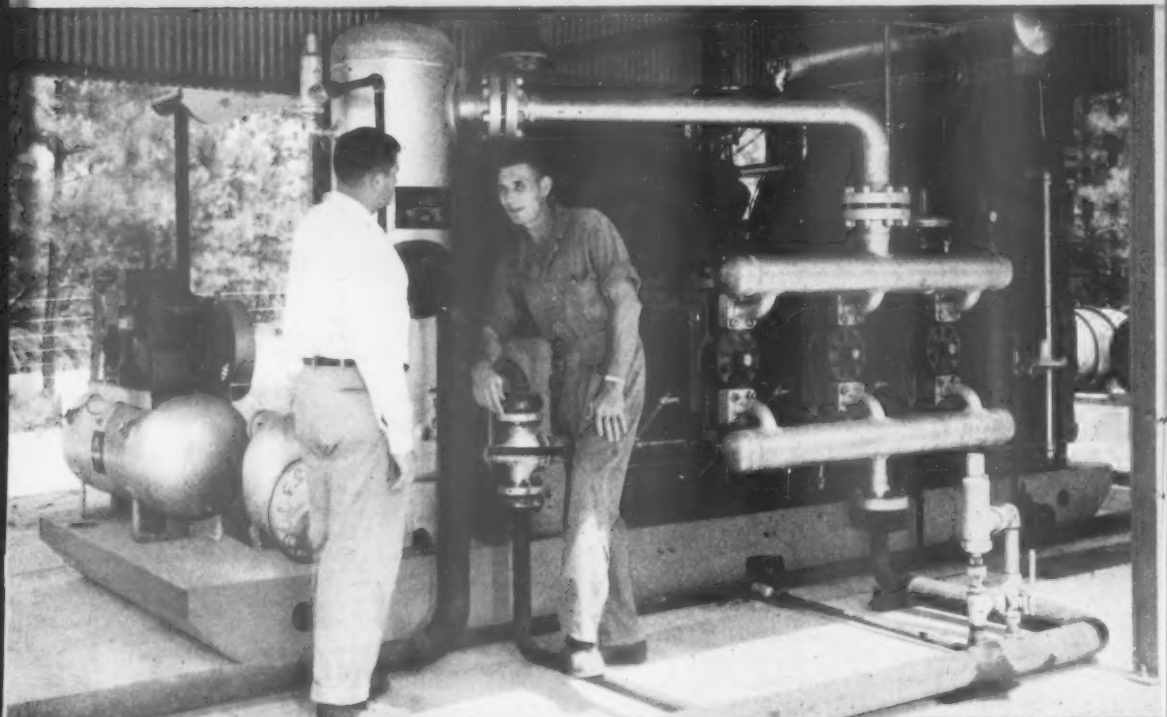

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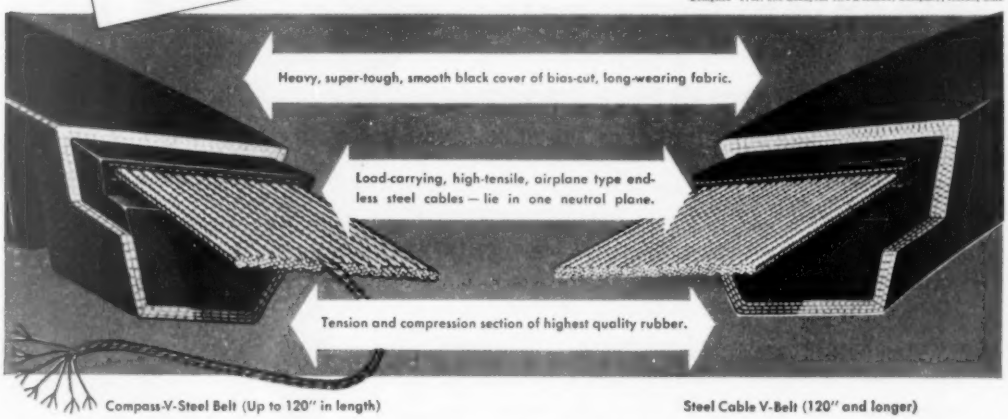
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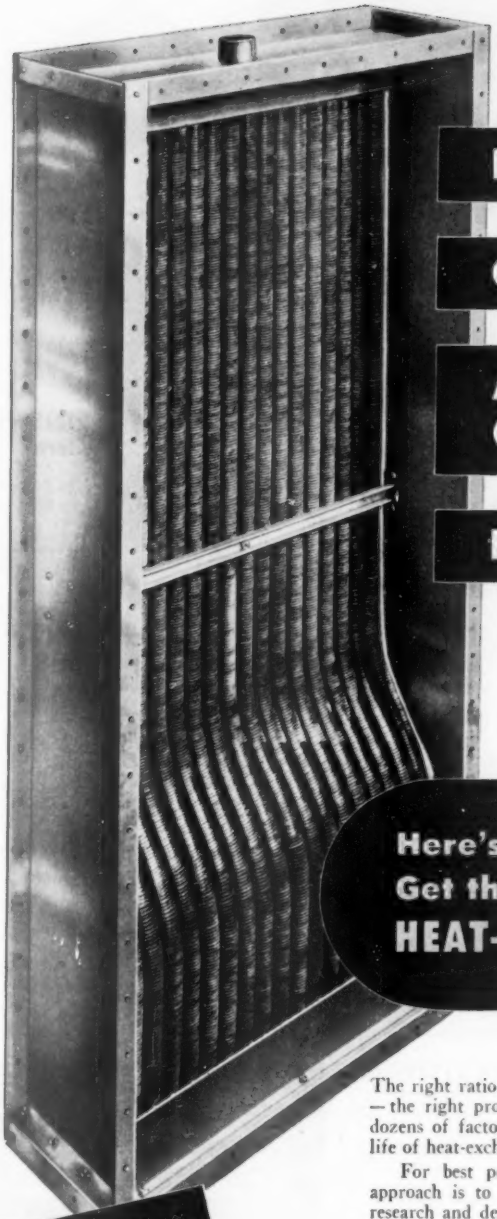

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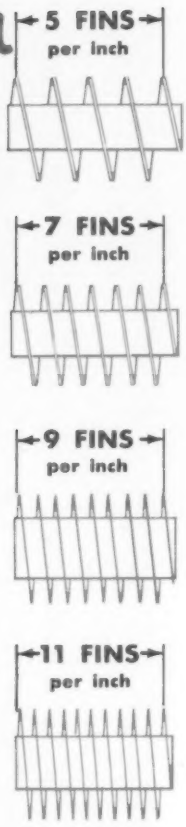

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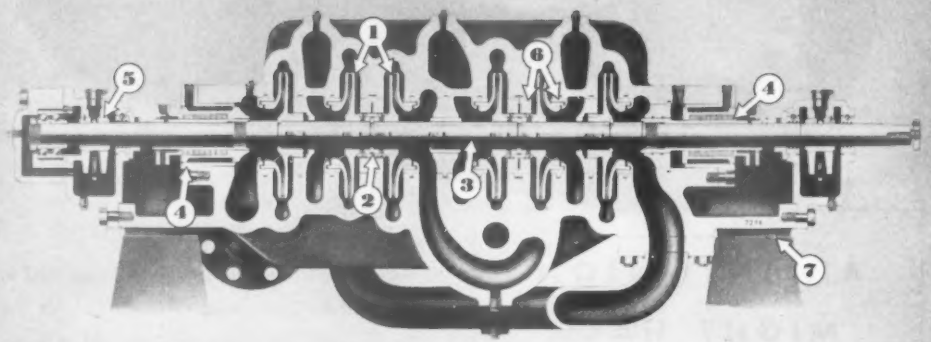

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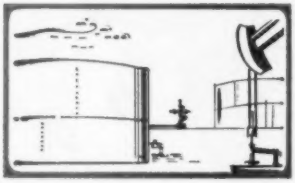

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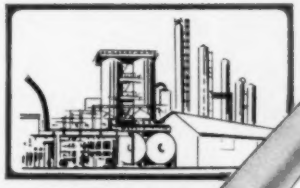
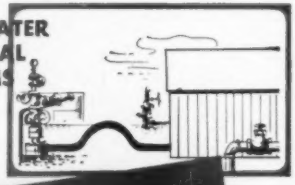
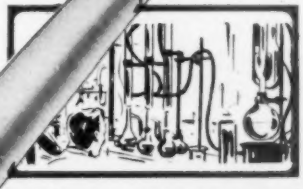


REFINERIES AND CHEMICAL PLANTS

SALTWATER DISPOSAL SYSTEMS



GAS DISTRIBUTION SYSTEMS



RESEARCH LABORATORIES

Plastic Pipe

Lighter weight
Longer Life
Corrosion resistant
Resists freezing
Easier to install
Costs no more
Immediate delivery.

Prompt delivery of the *right* plastic pipe for your requirements is assured by our complete stocks, which include all sizes from 12" through 6", made from these materials:

SARAN • POLYETHYLENE • BUTYRATE
RIGID VINYLS • HIGH IMPACT STYRENE
REINFORCED POLYESTER GLASS FIBER

All of our plastic pipe is made from virgin materials to insure highest quality. The polyethylene is gray; the butyrate is clear and permits watching the flow of fluid.

You are invited to make inquiries concerning the use of plastic pipe in your operations. We will be happy to make recommendations, and to furnish you with complete engineering and installation services. A full stock of sheet plastic and plastic rods is also carried.

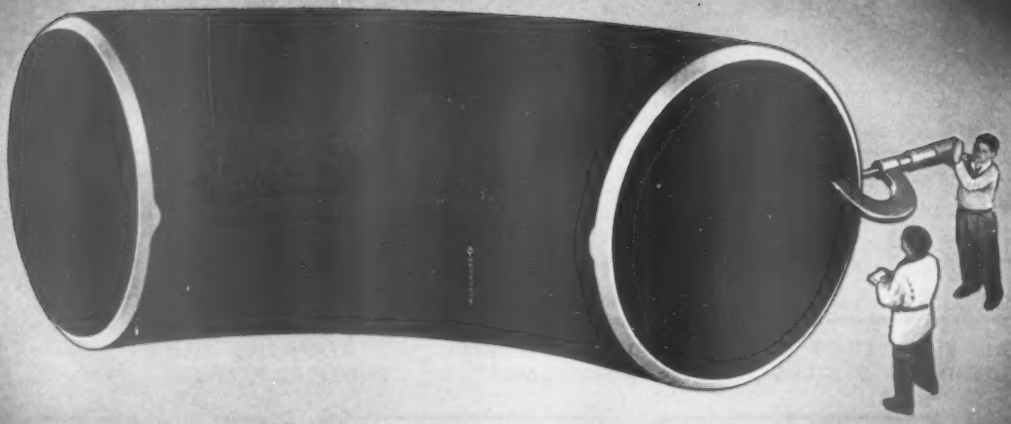
DID YOU KNOW . . .

CHECK THESE ADVANTAGES OF

. . . that Bettis Corporation has available engineering, fabricating and installation services for specialized polyvinyl chloride. For additional information on this material and these services, please contact us at Houston, Texas.

BETTIS CORPORATION

320 South 66th Street • Telephone YU-5401
P. O. DRAWER 9365 • HOUSTON, TEXAS



REGARDLESS OF SIZE . . . they must have *Dimensional Accuracy*

This photographic fantasy is simply to emphasize the excep- dimensional accuracy and uniformity of Midwest Welding

MIDWEST
PIPING & SUPPLY CO., Inc.

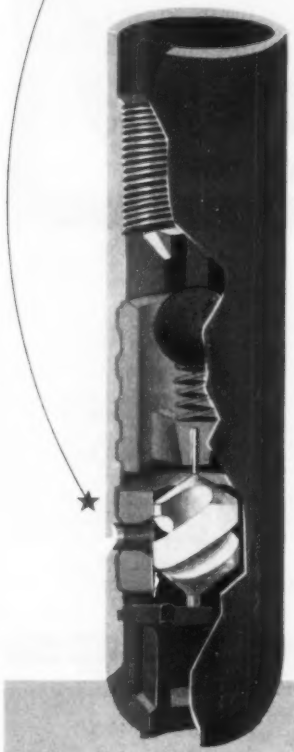
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic, Los Angeles and Boston
Sales Offices: New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave.
Tulsa 3—224 Wright Bldg. • Boston 27—426 First St.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

4582

HALLIBURTON'S TURBO JET

GIVES YOU BETTER CEMENTING WITH HIGH SPEED JETTING!



ROTOR SPEEDS TO 3000 r.p.m. jet off mud cake and penetrate bridges as Halliburton's new Turbo-Jet Shoe floats and guides either rotating or reciprocating pipe during your casing cement job. You get the net advantage of a superior bond and equal distribution of cement with greatly minimized channeling even when the Turbo-Jet rests on bottom!

NOT JUST A WHIRLING ACTION... No other design available today contributes as much to completely satisfactory cementing. Designed by men who know cementing best, the exclusive Halliburton Turbo-Jet hydraulic principle *jets* out 40% of the fluid through side ports at a 45° downward angle – 60% out through the end of the casing shoe.

All parts are precision engineered of drillable materials. The aluminum rotor shows no wear after as much as 26 continuous hours of handling fluids at high speeds under high pumping pressures.

Remember, when you get Turbo-Jet, you're taking advantage of Halliburton's million well job experience in pioneering and proving better methods for better cementing. Contact your nearby Halliburton Representative. Or write Halliburton Oil Well Cementing Company, Duncan, Okla.

HALLIBURTON

YEARS AHEAD IN FLOATING EQUIPMENT

EXTRA-TOUGH BRONZE VALVES

FOR LEAK-PROOF SERVICE!

Usual Bronze Valve Diaphragm Construction

Hancock Bronze Valve Diaphragm Construction . . . 125% to 230% Stronger

When you buy bronze valves, get what you want – greatest efficiency, longest service, biggest savings. Extra-tough Hancock Bronze Valves assure *all three* with features like these:

- ✓ "500 Brinell" Stainless Steel Plug Seat and Disc prevent leaks.
- ✓ 125% to 230% Stronger Diaphragm than ordinary bronze valves.
- ✓ Hard-Rolled Bronze Stem (Acme threads) takes the roughest treatment.
- ✓ Long-Lasting, Seal-Tight Packing cuts maintenance.
- ✓ Real Back Seating makes packing easy under pressure. Direct seat between stem and bonnet — away from heat and flow of pressure media.
- ✓ Rigid Body, Bonnet and Bonnet Ring of durable steam bronze withstand installation and service abuse.
- ✓ Cool, Comfortable Handwheel built to operator specifications.

Durable Hancock Bronze Valves are made in sizes from ¼" through 2" – globe and angle types, screwed ends — for 150#, 200# and 300# W.S.P. ratings. Phone your nearby Hancock Distributor for prompt delivery. Remember, Hancocks cost no more than ordinary bronze valves.

When Hancocks go in, valve costs go down.

1877 HANCOCK U.S.A.

HANCOCK VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** WATERTOWN 72, MASSACHUSETTS

MAKERS OF 'HANCOCK' VALVES, 'ASHCROFT GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

MILESTONES IN CAMERON PROGRESS

Old Davenport was no loveseat

It was a bad break for the operator when Davenport No. 1 blew out and cratered. This well in the La Blanca Field of South Texas was blowing an estimated 100 million cubic feet of gas and oil daily over the countryside. That was in 1938.

The Cameron Pressure Operated Gate Valve had been perfected as a drilling master valve to prevent blowouts, but it was also destined to become equally valuable for another service . . . as a capping valve for wild wells. Its first assignment as such was on the Davenport well, where it took the full volume of high pressure flow for *four days* while the capping manifold was being tied down. Then, although its seat was substantially sand cut by the well flow, the Cameron Pressure-Operated Gate Valve closed and sealed tightly. Scores of wild wells have since been tamed with this remarkable valve.

Today, the world over, oil men look to Cameron for the ultimate in protection against unruly well pressures.

C. I. W., Inc., P. O. Box 1212, Houston, Texas. Export: 7912 Empire State Bldg., New York, N. Y.

Snow Train!

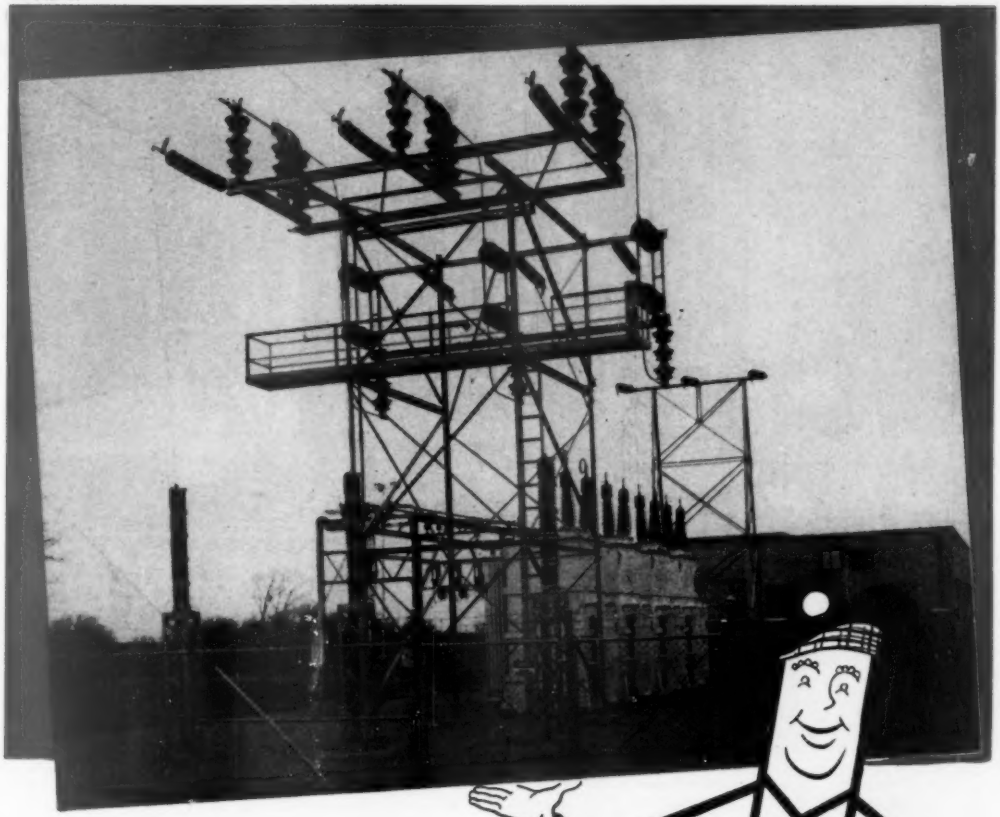
1. **Through blizzards,** over treacherous crevasses, and across frozen lakes, regularly scheduled "trains" of sleds deliver supplies to ice-locked trading posts in the Far North. Track-type Tractors haul several sleds, and a caboose in which the men eat and sleep. "Cat" drivers ride in open cockpits, ready to jump at first sign of trouble.

2. **The tractor train** is an example of engineering at work to provide better transportation under extreme conditions. To provide better transportation —for *you*—under *all* driving conditions, engineers developed an amazing heavy duty motor oil—Conoco Super—to help make engines last longer, perform better. And here is the proof ➞

3. **50,000 Miles—No Wear!** After a punishing 50,000-mile road test, *with proper drains and regular care*, engines lubricated with Conoco Super Motor Oil showed *no wear of any consequence:* in fact, an average of less than one one-thousandth inch on cylinders and crankshafts. Gasoline mileage for the *last* 5,000 miles was actually 99.77% as good as for the *first* 5,000. Proof that Conoco Super, with OIL-PLATING, *can* help keep engines *new!*

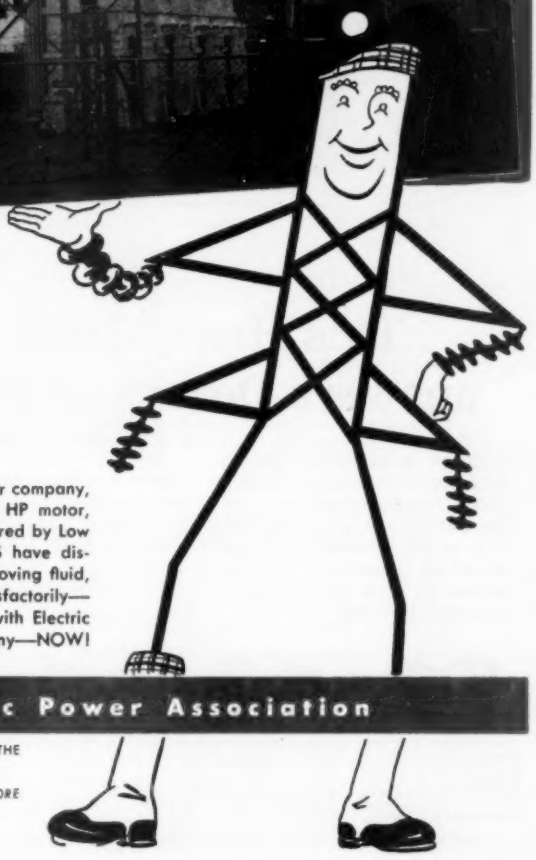
This heavy duty oil is now being sold coast to coast by Continental Oil Company, pioneer in petroleum since 1875. Many additional dealers throughout the nation are now featuring it as their "premium" motor oil. Ask *your* dealer for Conoco Super Motor Oil.

© 1952 CONTINENTAL OIL COMPANY



I'm shouldering the Power Load for Pipeline Operators . . .

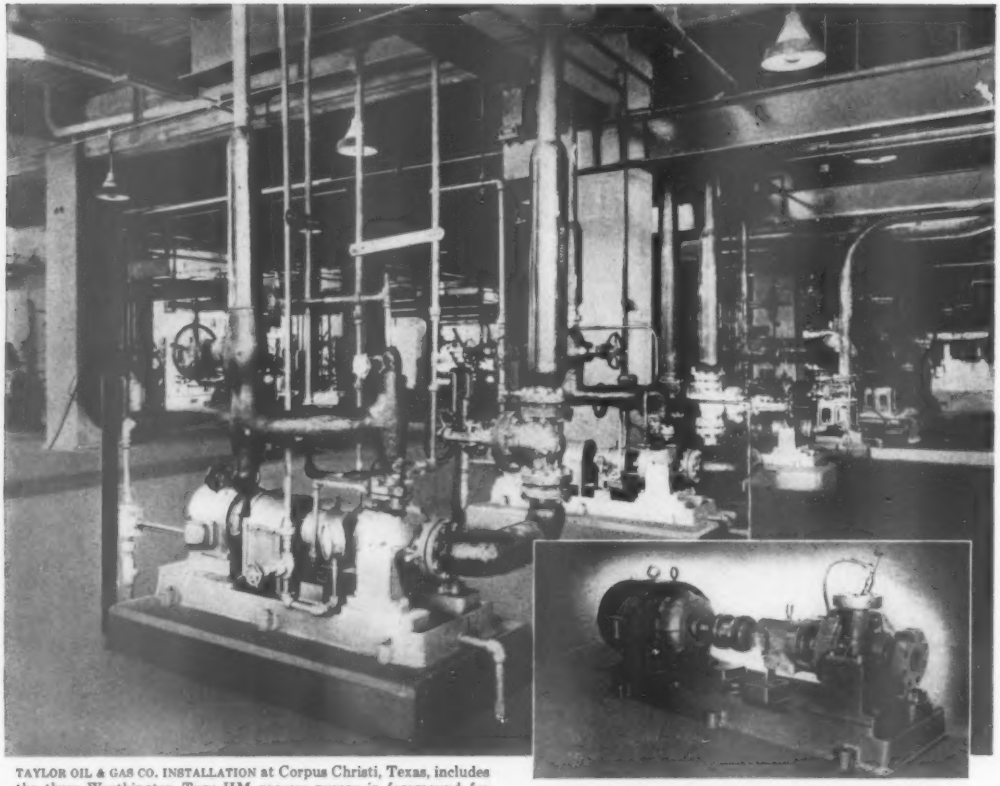
This Crude Pipeline Station, operated by a major company, in Osage County, Oklahoma, utilizing 1-1500 HP motor, 2-1250 HP motors and 1-750 HP motor is powered by Low Cost Electric Power. Yes, PIPELINE OPERATORS have discovered, regardless of the job to be done in moving fluid, that Purchased Electric Power can do it more satisfactorily—*and for less.* Simplify YOUR power problems with Electric Power. Call your nearest Electric Service Company—NOW!



Petroleum Electric Power Association

ORGANIZED IN THE INTEREST OF GREATER SERVICE TO THE PETROLEUM INDUSTRY

CALL YOUR NEAREST ELECTRIC SERVICE COMPANY FOR MORE FACTS OR ADDRESS YOUR REQUEST TO P. O. BOX 2771, DALLAS, TEXAS



TAYLOR OIL & GAS CO. INSTALLATION at Corpus Christi, Texas, includes the three Worthington Type-HM process pumps in foreground for pumping gasoline at 310 F. Pumps in background are Worthington Type HR's.

WORTHINGTON TYPE-HM CENTRIFUGAL PUMP—a really versatile process pump—is available with conventional stuffing box or mechanical seal, in cast iron, bronze, carbon steel, stainless steel and Worthite.

This Heavy-Duty Process Pump answers Dozens of Pumping Problems

This is a heavy-duty process pump that will handle hydro-carbons such as propane, butane, naptha, gasoline and oil . . . chemicals such as SO_2, caustics, freon and anhydrous ammonia . . . and can be used for boiler feed and heater drain service as well.

It's designed for continuous service and will withstand hot or cold liquids . . . suction pressures to 300 lbs . . . and corrosive or non-corrosive liquids. It's *water-jacketed* but built so that it *can be installed without water cooling* where pumping temperatures permit.

Learn more about this Worthington Type-HM Process Pump and what it can do in your refinery pumping applications.

Write for Bulletin W-341-B14 to Worthington Corporation, Centrifugal Pump Division, Harrison, New Jersey.

* C.2.10

Types HR and HB. Twenty sizes. Capacities up to 1,800 gpm. Developed heads up to 900 ft. Proper selection of material permits use for temperatures far below zero to 800 F, for pressures from high vacuum to 750 psig.

Type HD. Hydraulically-balanced double-suction impeller handles boiling liquids with low submergence. Capacities range from 600 to 3,200 gpm at heads up to 700 ft. To 850 F and 550 psig.

Type CNE. For loading or transfer service. Capacities to 1,500 gpm. Heads to 500 ft.

Type HM. Available in 12 sizes. Capacities to 700 gpm. Heads to 475 ft. Up to 500 F.

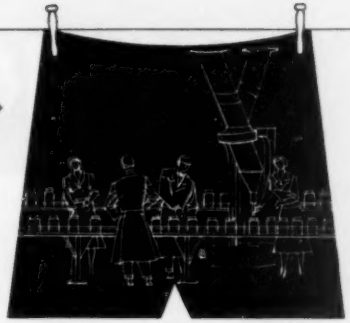
WORTHINGTON

Centrifugal Pumps

The World's Broadest Line Assures You the Right Pump for Every Job

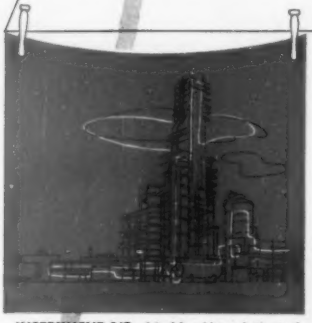
There's no limit

STOREROOMS, dried with Alcoa Activated Alumina, protect raw materials and finished products from moisture deterioration.



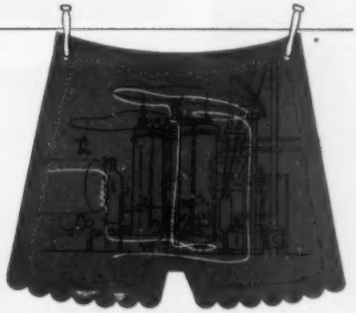
PACKAGING AND PROCESSING ROOMS in food, drug and candy plants are kept at uniform humidities with Alcoa Activated Alumina, to maintain production regardless of the weather.

to what you can dry



INSTRUMENT AIR, dried by Alcoa Activated Alumina, prevents freeze-ups and corrosion of outdoor valves, trips and recorders.

LABORATORIES testing paper, textiles, chemicals require controlled humidity provided by Alcoa Activated Alumina.



PETROLEUM PRODUCTS—liquids, gases or gaseous hydrocarbons—can be dried to minus 100°F dew point—or *lower!*

with ALCOA Activated Alumina!

ALCOA Activated Alumina is the "old reliable" in the desiccant field. It dries to lower dew points than other commercial adsorbents. It will not swell, soften or disintegrate . . . can be used over and over again almost indefinitely.

Now *new* and *better* Activated Aluminas are on the way, with improved forms and properties. Let us tell you more about these efficient, economical desiccants. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 618-L Gulf Building, Pittsburgh 19, Pa.

Alcoa Chemicals

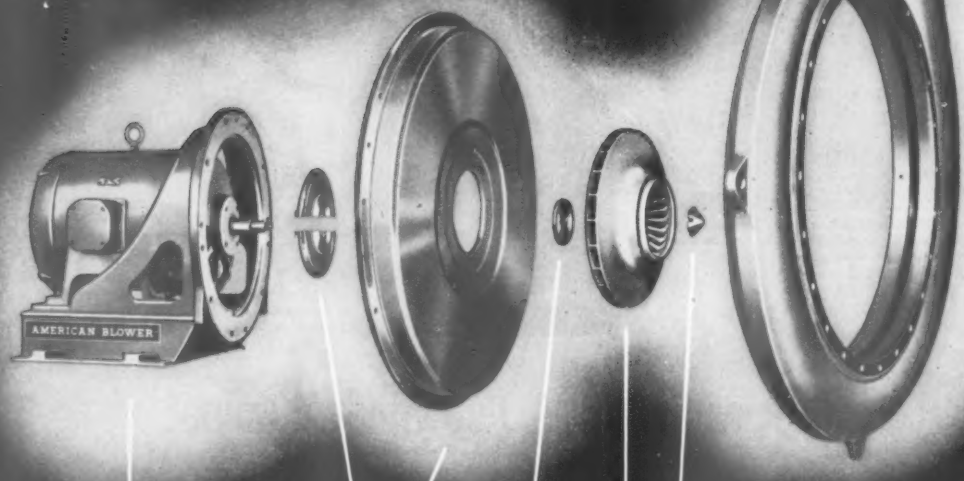
ALCOA

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

AMERICAN BLOWER

centrifugal



Motor — Standard NEMA construction. Short motor shaft extension and conservative impeller loads assure operation below first critical speed of rotor assembly. **Baseplate** — heavy welded steel for rigidity and accurate alignment.

Shaft Packing — Nonferrous, cast construction. No mechanical contact between stationary and rotating parts. **Backplate** — cast iron, bolts with dowel fit to baseplate.

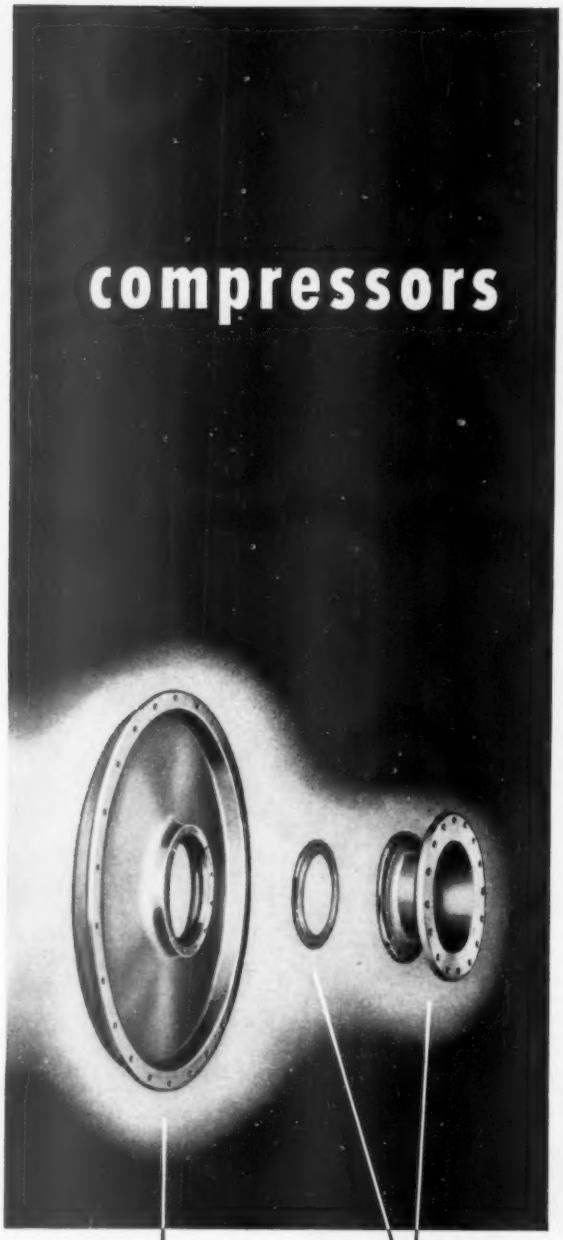
Spacer Disc

Impeller—Shrouded, single-piece, heat-treated, cast-aluminum alloy construction. Statically and dynamically balanced. Overspeeded to 20% above maximum operating speed before assembly.

Shaft Nut

Volute Casing — Cast-iron construction. Bolts with dowel fit to backplate. Twenty-four casing positions available in either direction of rotation.

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER



Suction Cover—Cast-iron suction cover forms outer wall of diffuser passage and bolts with dowel fit to volute casing.

Annulus Packing—Permits accurate alignment with impeller during assembly. **Inlet Nozzle**—Provides uniform gas distribution. Flanged for standard pipe connections.

Designed for

EFFICIENCY

Built for

DEPENDABILITY

American Blower Single Stage Centrifugal Compressors offer several outstanding design features.

For example, the improved scroll design and deep diffuser passage efficiently convert velocity energy into pressure. Labyrinth annulus packing minimizes recirculation of gas around impeller inlet. Aerodynamic design of impeller blade inlets results in high efficiencies and dependable performance.

Before shipment, each compressor is thoroughly tested in accordance with A.S.M.E. Power Test Code for Centrifugal Compressors and Exhausters.

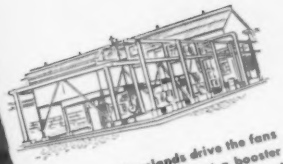
American Blower single stage units are available in sizes from 30 to 600 HP with pressures from 1¼ to 3¾ lbs. For technical data consult the nearest American Blower Branch Office or write us for Bulletin 109.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

AMERICAN BLOWER

CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON



These four Clevelands drive the fans in jacket water coolers at a booster station picking up flare gas. Installed at the Alma, Oklahoma, plant of a well-known oil company. Scores of similar installations are in service in the petroleum industry.

CLEVELAND CU units drive jacket water coolers

THE CU unit is a vertical worm gear drive designed especially to operate the fans of cooling towers. Widely used throughout industry, it is of particular interest to oil and gas producers and refiners.

Extreme conditions of heat, humidity and dust do not interfere with the dependable performance of this Cleveland drive. It carries high thrust loads and high radial loads with maximum efficiency. It lends itself to rugged mounting and is easily installed, serviced and adjusted in the field. Every unit is run in and pretested under load before it leaves the factory. And the experience of hundreds of users demonstrates that it operates quietly and continuously, at high speeds and for long periods.

For full description and engineering data on the Type CU drive, write for Bulletin 135. Also available is a big new catalog (No. 400) of the complete Cleveland line of worm gear speed reducers. Ask for it on your letterhead. The Cleveland Worm and Gear Company, 3286 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

Don't *"get in a stew"* over corrosion problems!

When you're faced with a difficult corrosive condition, avail yourself of Metal Goods Corporation's long experience in supplying corrosion-resistant metals.

No other warehouse has more technical and school-of-hard-knocks experience in battling corrosive attacks. This explains why the petroleum industry turns to Metal Goods Corporation year after year to assist it in bringing about a reduction in costly shutdowns.

To get the facts about your specific corrosion problem... to get the most dependable corrosion-resistant alloys . . . call your nearest Metal Goods Corporation representative.

Please call, wire, or write the following Metal Goods Corporation representative nearest you.

OFFICES AND WAREHOUSES

St. Louis 15, Missouri
5239 Brown Avenue
Nelson L. Hower
Phone: GOodfellow 1234

Kansas City 16, Mo.
1300 Burlington
Frank D. Hogan
Phone: NOrclay 3516

Tulsa 3, Oklahoma
302 North Boston
Scott J. Harrison
Phone: 4-1175

Houston 3, Texas
711 Milby Street
Harris T. Gregg
Phone: CEntral 8881

Denver 2, Colorado
2425 Walnut Street
Neal Dehn
Phone: AComa 5891

Dallas 9, Texas
6211 Cedar Springs Rd.
Sam D. Hodgdon
Phone: ELmhurst 3271

New Orleans 12, La.
432 Julia Street
Carl T. Wedemeyer
Phone: CAnal 7373

SALES SERVICE OFFICES

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2200 East Central
Ray Noller
Phone: 7-8921

Jackson, Mississippi
781 Raymond Road
George E. Akerberg
Phone: 5-2711

Decatur, Illinois
1305 West Sunset
Arlie W. Tempel
Phone: 8-1314

Baton Rouge, Louisiana
4419 Mimosa Street
Paul P. Vidovic
Phone: 4-4738

Indianapolis 2, Ind.
1333 N. Pennsylvania
Harry L. Newton
Phone: Lincoln 4980

Memphis, Tennessee
713 Columbian Mutal Tower Bldg.
Robert W. Downs
Phone: 5-8721

Omaha, Nebraska
3515 No. 67th Avenue
C. M. Cooley
Phone: WAlnut 1112

Beaumont, Texas
238 Bowie Bldg.
Lee T. Dodson
Phone: 4-7536, 4-7537

Fort Worth, Texas
3821 Cerolyn
John M. Turbitt
Phone: FOrtune 4369

San Antonio, Texas
2012 Alamo Natl. Bldg.
Ray D. Bagaley
Phone: GArfield 3161

Davenport, Iowa
924 State Street
Robert L. Tharp
Phone: 2-3156

METAL GOODS CORPORATION

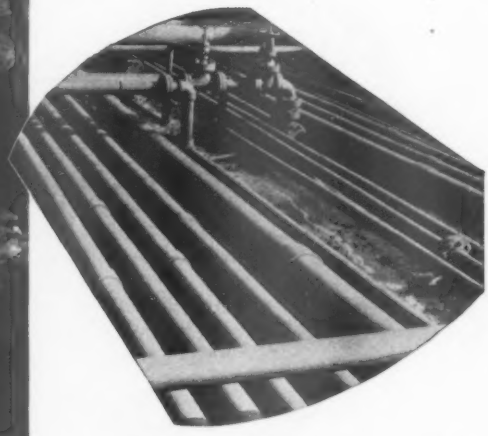
GENERAL OFFICES: ST. LOUIS 15, MISSOURI

THERE'S A

REPUBLIC STEEL PIPE

FOR EVERY OIL AND GAS HANDLING NEED

ELECTRIC RESISTANCE WELDED LINE PIPE—offers the construction and operating advantages of uniform size, roundness, diameter, and wall thickness . . . uniform high yield strength . . . uniformly straight long lengths . . . ease of bending and welding . . . freedom from scale . . . inside and out inspection. The more than 59,000 miles placed in service over the past twenty years—in transmission, distributing, collecting and products lines—prove its dependability.



CONTINUOUS WELD STEEL PIPE—made under Republic's improved continuous weld process is uniformly strong, ductile, clean, and scale-free. It is uniform in wall thickness, diameter, and concentricity . . . is easy to bend, thread and close-coil . . . easy to weld by all modern methods. It comes in economical uniform long lengths, and in extra long lengths.

LARGE DIAMETER ELECTRIC FUSION WELDED LINE PIPE—high pressure line pipe in sizes 24-, 26-, and 30-inch OD. Electric fusion welded inside and out, and hydraulically expanded to uniform size, straightness and circumference. Hydraulic expansion also increases yield strength for safe handling of high pressures. Always-constant circumference and uniform wall thickness help joints line-up accurately and quickly, speed field welding.

WRITE FOR LITERATURE

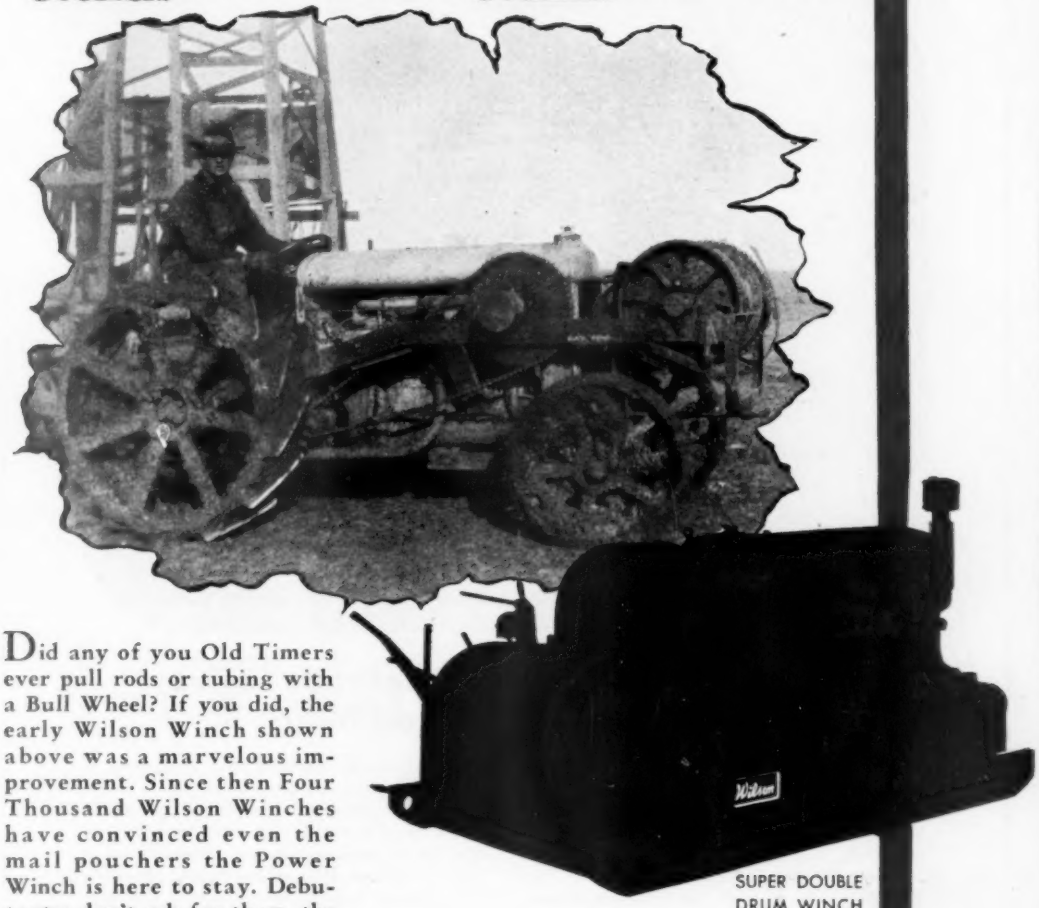
REPUBLIC STEEL CORPORATION

General Offices: Cleveland 1, Ohio • Export Department: Chrysler Building, New York 17, N. Y.

Other Republic Products include Casing and Tubing—Carbon, Alloy and Stainless Steels—Studs, Bolts and Nuts—Heat Exchanger Tubes

Remember . . . "ABOUT 4000 WINCHES AGO . . ."

Wilson WAS THERE! Wilson WAS FIRST!



SUPER DOUBLE DRUM WINCH

Did any of you Old Timers ever pull rods or tubing with a Bull Wheel? If you did, the early Wilson Winch shown above was a marvelous improvement. Since then Four Thousand Wilson Winches have convinced even the mail pouchers the Power Winch is here to stay. Debutantes don't ask for them, the Roustabouts do!

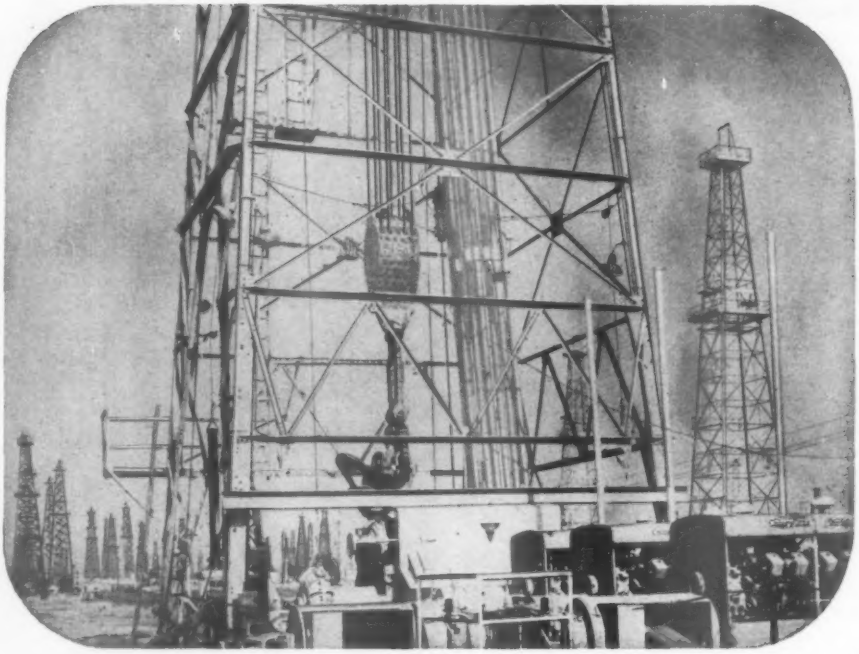
Wilson ADVANCED ENGINEERING GIVES YOU . .

- Better design
- Lower operating cost
- Longer life
- Better performance
- Simpler and easier operation and maintenance

COMPARE QUALITY . . . COMPARE PRICES BEFORE YOU BUY!

Wilson MANUFACTURING CO., Inc.
WICHITA FALLS, TEXAS

WIRE ROPE



This is the most economical rope we've ever made for the oil fields

ROEBLING is the best known name in wire rope. That's partly because we were the first wire rope makers in America. But more than that, we've always led in developing better wire and better rope for every purpose.

Today's Roebling Preformed "Blue Center" Steel Wire Rope is the oil man's best choice for efficiency and long life. This rope has *extra* resistance to crushing and abrasion . . . stands up under rough going. It saves you time and cuts costs.

There's a Roebling wire rope of the right specification for top service on any job. Call on your Roebling Field Man for his recommendations . . . District Offices at Cleveland, Denver, Houston, Los Angeles, Odessa and Tulsa. John A. Roebling's Sons Company, Trenton 2, New Jersey.

ROEBLING

DISTRIBUTED BY

THE NATIONAL SUPPLY COMPANY

REPUBLIC SUPPLY COMPANY

SO YOU NEED A LITTLE PACKING!

"PERFECTLY ENGINEERED PACKINGS"
LINEAR

It has been said that Linear makes "Perfectly Engineered Packings" — that Linear is, in fact, the measure of quality in packings.

We like these expressions. It is typical of Jones & Laughlin Supply Company policies that the man who needs a little packing must have as much consideration and protection as the man who wants to buy a drilling rig.

You'll get an extra measure of quality . . . a baker's dozen, so to speak . . . in the Linear Packings stocked by your near-by Jones & Laughlin Supply store. Try them, and note how well they last.

PRECISION MOULDED "V" AND "O" RINGS

Linear precision moulded "O" rings compounded of natural or synthetic rubber, fluorethylene polymers, and silastics, available in a complete range of J.I.C. and A.N. standard sizes as well as hundreds of non-standard sizes for special uses, have captured the interest of many designers. We also offer a complete line of fabric reinforced and homogeneous "V" type packings by Linear. Our engineers are qualified to discuss technical applications.

AMERICA NEEDS SCRAP TO MAKE MORE STEEL

Jones & Laughlin Supply Company

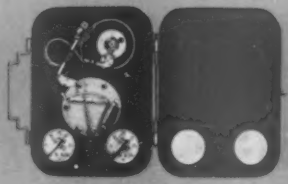
J&L STEEL

EXPORT: 405 Lexington Ave., New York, N. Y., U. S. A.
88 STORES • 19 OFFICES • 9 RESIDENT SALESMEN
General Offices: TULSA, OKLAHOMA

Subsidiary of Jones & Laughlin Steel Corporation

BACK PRESSURE REGULATOR
TYPE 196

LIQUID LEVEL CONTROLLER
TYPE 888



PRESSURE CONTROLLER
PILOT TYPE 1400

TIME CYCLE CONTROLLER
TYPE 995

IN THE OIL & GAS INDUSTRIES

CLIMAX

Place an orange star on every Climax Control and Regulator used in the oil and gas business and you'd give the entire industry the appearance of a constellation on earth. Climax Controls are so numerous . . . their applications so varied you'll find them wherever there is the smell of gas or crude; wherever men behind closed gates process and refine to get the many products that spring from oil and gas.

DRILLING 1

Even here ...at the very beginning...

you'll find Climax represented. At the drilling rig you're quite likely to see Climax Diaphragm Control Valves and Climax Fuel Supply Regulators. And as you progress still further into the various steps of the oil and gas industry you find Climax playing many vital roles.

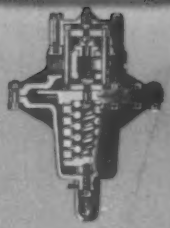
PRODUCTION 2

Operators lean heavily on Climax here. Around the wellhead there are Climax Controllers—Safety Shut-Off Regulators . . . Pressure Reducing and Back Pressure Regulators . . . Time Cycle Controllers for gas lift wells. For field gathering systems there are Climax Liquid Level Controllers, 3-way Valves, Pressure Controllers and Diaphragm Motor Valves used on dehydrators and desulfurizers. Climax Pressure Controllers are used on separators, low temperature separation units, BS&B Glycol Injection Systems (pictured here), emulsion treaters, free water knockouts, BS&B Stabilizers, indirect heaters and for automatic tank battery controls.

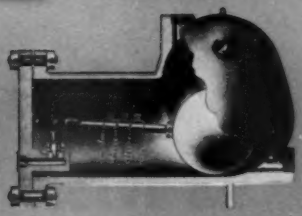
The Story of Climax Controls is a book in itself.

We would like you to have this book for ready reference. Several sections have been recently revised to cover new and improved Climax Controls. So that your business can keep up with consumption demands BS&B keeps Climax Controls ahead of the trend, to give you the very best and latest control and regulator equipment. Let us send you this book . . . it's FREE. Or, ask your BS&B Man. There are 76 Climax Control Centers to help you.

CLIMAX
BS&B
CONTROLS
OUR 60TH YEAR

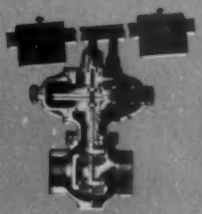


PRESSURE REDUCING REG.
TYPE 260



DUO-PHASE CONTINUOUS DRAINER
TYPE 90

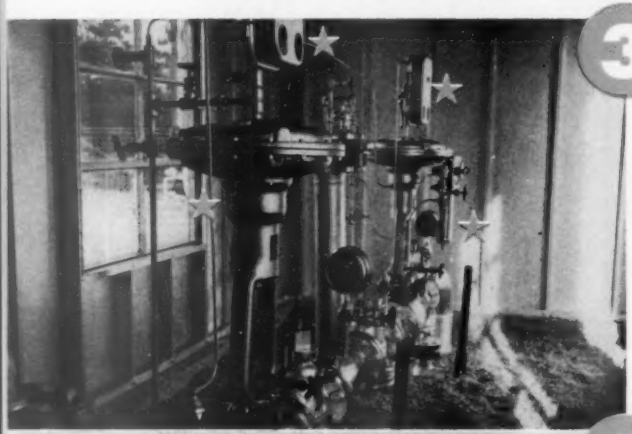
DIAPHRAGM CONTROL VALVE
TYPE 86



VACUUM REGULATOR
TYPE 8

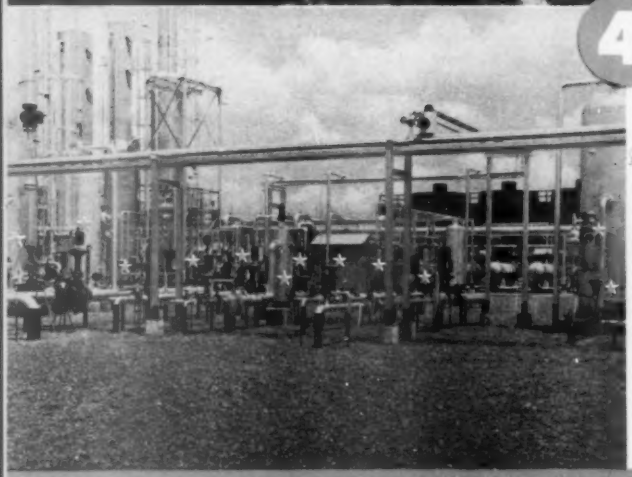
CONTROLS★ serve right down the line

...from drilling rig through refining



3 GAS PIPE LINES and Compressor Stations

The mission of Climax Controls carries right on through. Around gas pipelines and compressor stations the Climax name appears on many pressure controllers, diaphragm motor valves, drainers and traps. All along oil pipelines are Climax automatic controls for pump operation.



4 REFINING Gasoline Plants and Petro-Chemical Plants

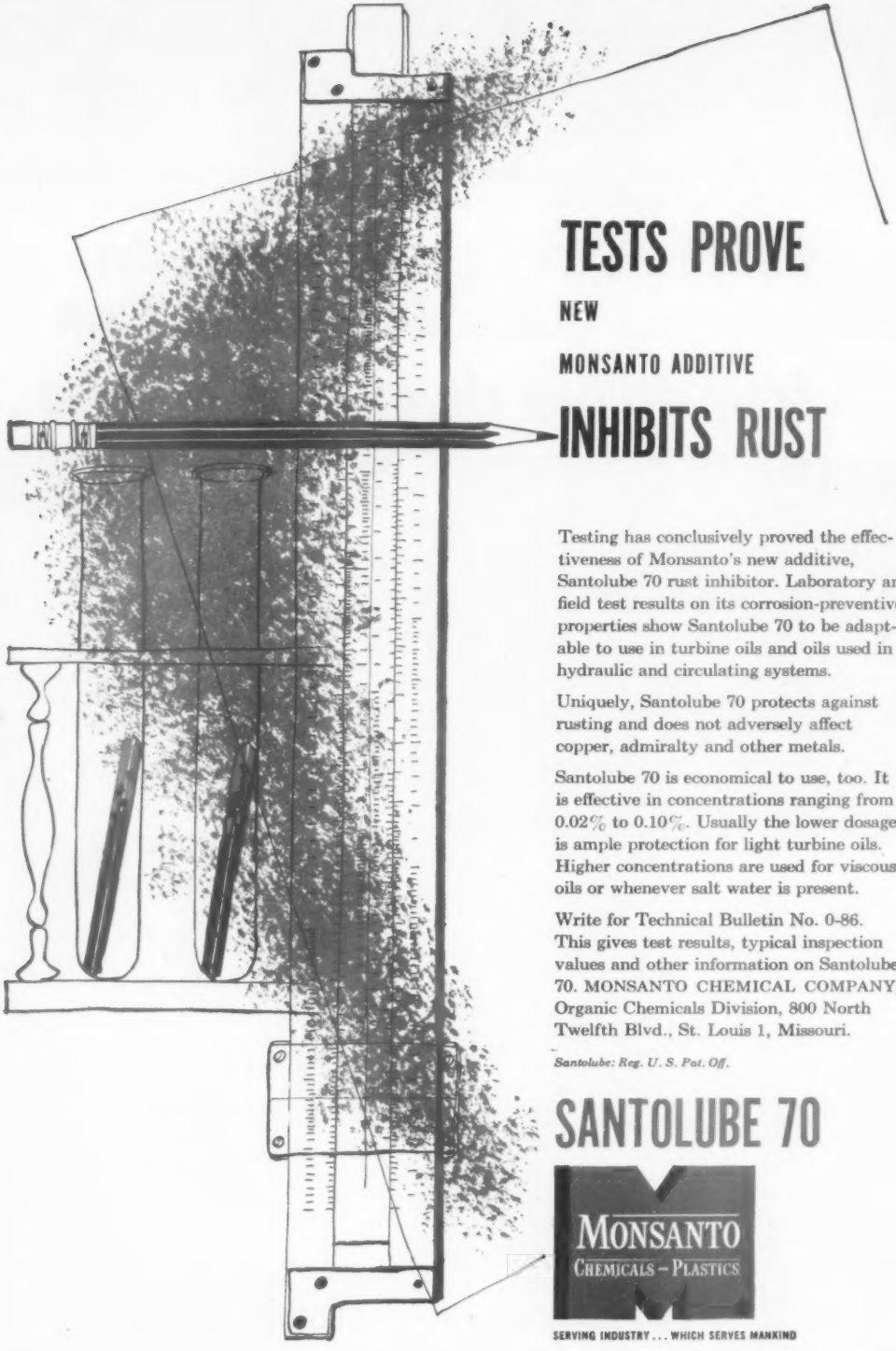
In this final stage of a major industry Climax Controls are very much in evidence. Throughout these orderly and concentrated jungles of piping, heat exchangers, vessels and ladders Climax does almost every conceivable regulating job, with Liquid Level Controllers, Pressure Controllers, Diaphragm Control Valves, Pressure Regulators and Relays.

BLACK, SIVALLS & BRYSON, INC.

Climax Controls Division Dept. 4-A11

7500 East 12th Street

Kansas City 3, Missouri



TESTS PROVE

NEW

MONSANTO ADDITIVE

INHIBITS RUST

Testing has conclusively proved the effectiveness of Monsanto's new additive, Santolube 70 rust inhibitor. Laboratory and field test results on its corrosion-preventive properties show Santolube 70 to be adaptable to use in turbine oils and oils used in hydraulic and circulating systems.

Uniquely, Santolube 70 protects against rusting and does not adversely affect copper, admiralty and other metals.

Santolube 70 is economical to use, too. It is effective in concentrations ranging from 0.02% to 0.10%. Usually the lower dosage is ample protection for light turbine oils. Higher concentrations are used for viscous oils or whenever salt water is present.

Write for Technical Bulletin No. 0-86. This gives test results, typical inspection values and other information on Santolube 70. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.

Santolube: Reg. U. S. Pat. Off.

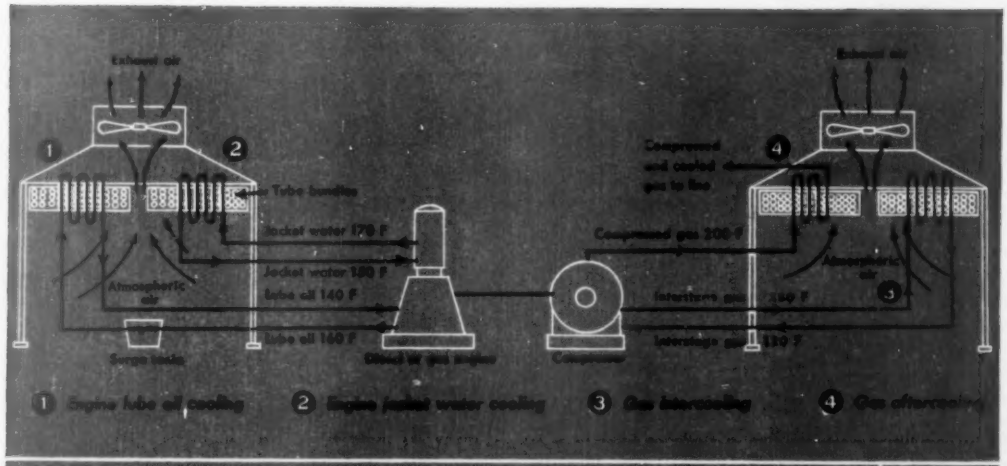
SANTOLUBE 70

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

ALCO AIRCOOLERS

SOLVE ALL 4 COOLING PROBLEMS



in high-pressure gas compressor stations

In a typical high-pressure gas compressor station, two ALCO Aircoolers shown in the illustration perform four major cooling duties: (1) engine lube oil cooling (2)engine jacket water cooling (3) gas intercooling (4) gas aftercooling.

Versatile ALCO Aircoolers are particularly effective in this type installation because they are designed to give long, efficient performance. Such troubles as scale, costly water treatment and other cooling problems are eliminated.

The heart of the ALCO Aircooler is the ALCO fin tube, which provides an extended outside surface for maximum heat transfer efficiency, coupled with low air-flow resistance for economy in operation. A continuous helically wound copper fin is bonded to the tube with lead-tin alloy, and the external tube surface is coated with this alloy to improve atmospheric corrosion resistance. The entire unit is quickly and easily assembled in the field.

To put all these money saving features to work for you, call your nearest ALCO Sales Engineer at Beaumont, Chicago, Houston, Los Angeles, New York or Tulsa for more information or

Send Coupon for ALCO Aircooler Bulletin.

ALCO

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
Plants: Dunkirk, New York • Beaumont, Texas

***In step with tomorrow*— ALCO AIRCOOLERS, Heat Exchangers, Evaporators, Feedwater Heaters, Pressure Vessels, Pipe**

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
Schenectady, N. Y.

Gentlemen: Please send me the ALCO Aircooler Bulletin.

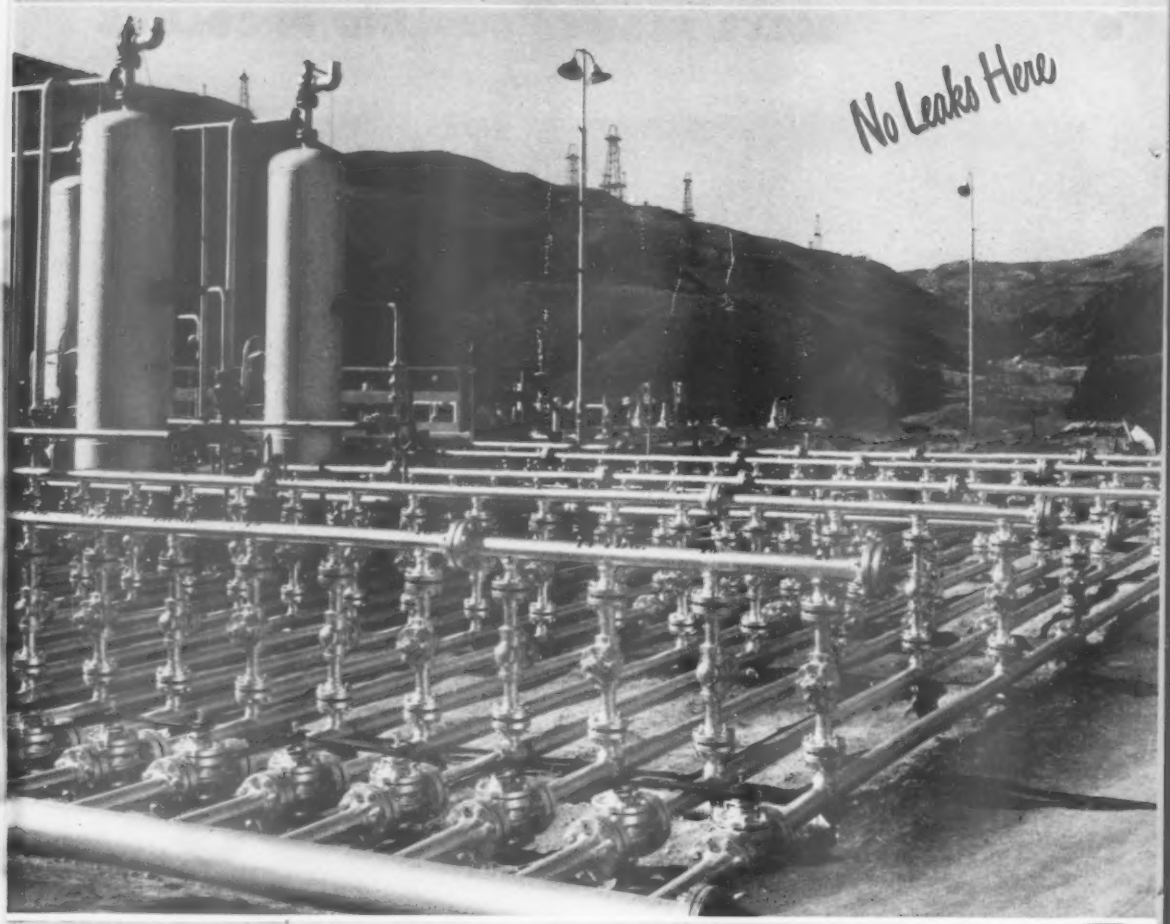
Name..... Position.....

Company.....

Address.....

City..... Zone..... State.....

Nordstrom Valves on These Production

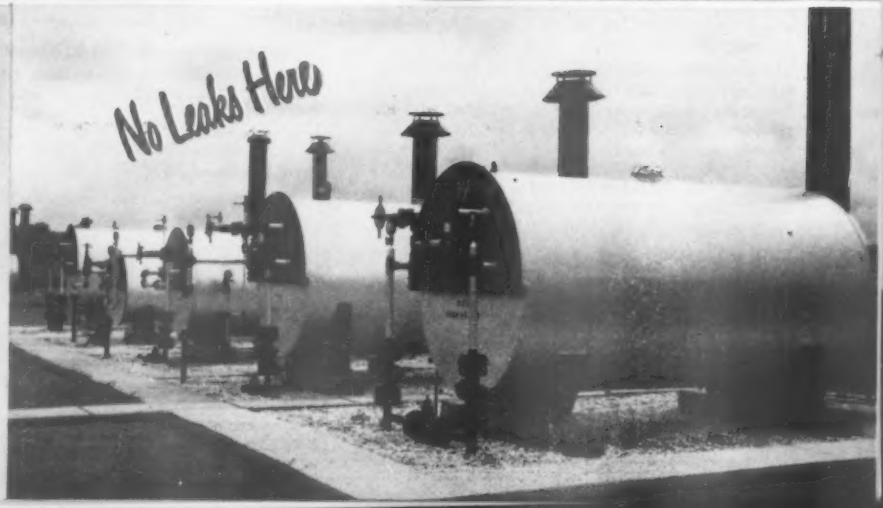


CRUDE OIL MANIFOLD

Both this crude oil manifold and the separators in the back are controlled with easy operating but tight closing Nordstrom valves.

UNIT HEATERS

Nordstrom Hypreseal valves installed on unit heaters connected to flowing wells in Louisiana.



Services Mean "No Leaks Here"

Production services are hard on valves.

In the broad Nordstrom line, there are valves especially designed to overcome corrosion, erosion, high pressures and other difficult problems so often encountered in field service.

For manifolds, tank batteries, Christmas trees, separators, repressuring systems, meter settings, transmission lines or drilling applications there are always Nordstrom valves of the right size, working pressure and material.

Too, in production service where valve repairs are often impossible without a costly shutdown, Nordstrom valves prove their real economy. Nordstrom's patented internal lubricant system keeps them ready to operate at all times. A quick quarter-turn changes them from open to closed in seconds.

Just as important, the double seal of Nordstrom lubricant around the seat means positive shut-off in hard service, regardless of how long the valve is in one position or how often it's operated.

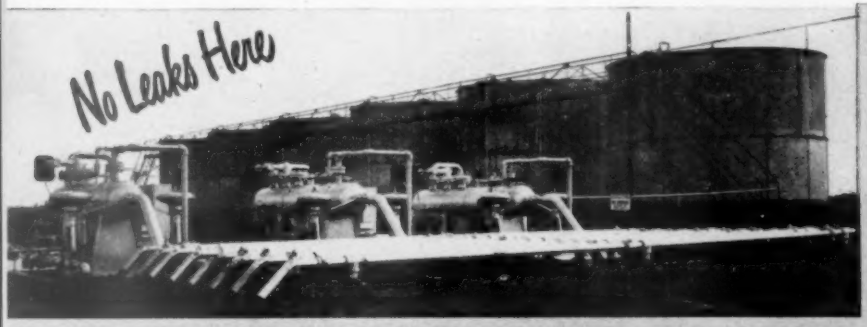
To production men, a Nordstrom installation means "No Leaks Here."

Write for Catalog of Nordstrom oil field production valves, No. V-208, Rockwell Manufacturing Co., 400 N. Lexington Ave., Pittsburgh 8, Pennsylvania.

ROCKWELL Another Rockwell Product **Built**

Nordstrom Valves

LUBRICANT SEALED FOR POSITIVE SHUT-OFF



TANK BATTERIES The tank batteries, foreground, and portable separator units, background, are both Nordstrom-valve equipped.

CHRISTMAS TREE Nordstrom Hypreseal on 15,000 lb. test Christmas tree in Gulf area. Pump carries inhibitor into well head to prevent corrosion.

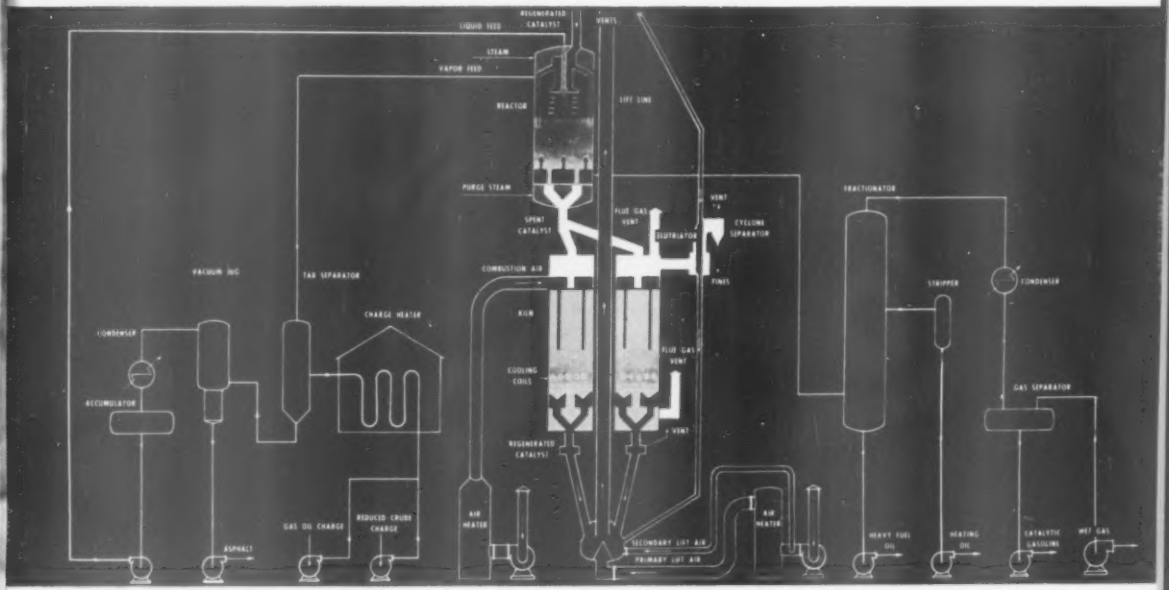
SALT WATER DISPOSAL Nordstrom Hypreseal valve, with Merchrome hard-faced plug and flow passages on Louisiana well.

Wherever you are in the oil fields, there's a supply store with Nordstrom valves and Nordstrom service nearby.

BLAW-KNOX is licensed and equipped to build

Thermofor Catalytic Cracking Plants TCC

THE HIGH-OCTANE, LOW-COST PROCESS NOW AVAILABLE TO ALL PETROLEUM REFINERS



There's no doubt about the high efficiency of Socony-Vacuum's TCC process but, until very recently, the investment required made it "off limits" for all but the largest refiners. Today it's a different story. Through redesign and the elimination of much field construction, all items of equipment are now prefabricated and shipped direct to the plant site and put in place with speed and economy—bringing the cost per barrel capacity down to that for larger TCC units. The engineers of Chemical Plants Division will be glad to discuss the possibilities of a TCC plant for your operation and profit.

Chemical Plants Division has wide experience in:

- Catalytic Cracking
- Catalytic Reforming
- Polymerization
- Alkylation
- Coking
- Vapor Recovery
- Crude Distillation
- Asphalt
- Natural Gasoline Plants
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- Dehydration
- Amine Treating
- Super Fractionation
- Petrochemical
- Low Temperature Processes
- Oxyl
- Oxo
- Chlorine

BLAW-KNOX

CONSTRUCTION COMPANY

CHEMICAL PLANTS DIVISION

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High Torque and Rugged Construction Keep Pumping Units on the Job 24 Hours a Day

For pumping units, you'll find that Century high torque, "high slip" motors are ideal. The high torque starts the stiffest pumps easily.

The "high slip" feature saves wear and tear on both your motor and pump. The motor speed pulls down as the load comes on . . . cushions the impact and reduces the shock of the peak load.

For all popular applications in the oil industry, there are Century motors that assure top performance. They're available for single phase or polyphase, in a wide range of types and kinds—in sizes from 1/8 to 400 horsepower. Whether for producing, refining, or distributing petroleum products, it will pay you to specify Century motors.

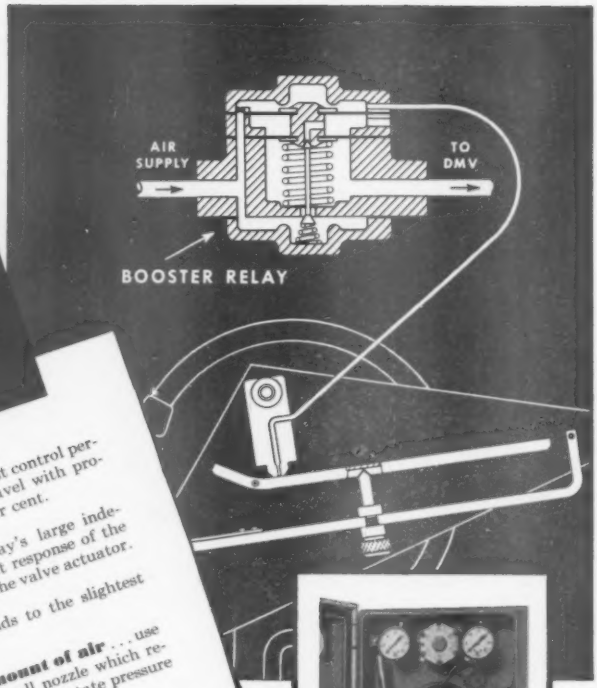
Offices and stock points in principal cities

726

CENTURY ELECTRIC COMPANY
1806 Pine Street • St. Louis 3, Missouri

Century MOTORS

It's the **BOOSTER RELAY** that gives this Pressure Controller these **4** exclusive features

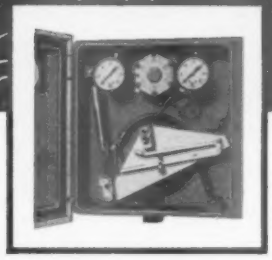


1 It's accurate . . . provides closest control performance, including full valve travel with proportional band set as low as 1 per cent.

2 It's fast . . . the booster relay's large independent air supply permits fast response of the valve, regardless of the size of the valve actuator.

3 It's sensitive . . . responds to the slightest pressure changes.

4 It uses a minimum amount of air . . . use of booster relay permits small nozzle which requires only 0.1 scfm under steady state pressure conditions.



New Honeywell Pressure Pilot

In ruggedness, too, the Pressure Pilot leads the way. It goes anywhere . . . takes the toughest field conditions in stride. It makes a fitting companion, of course, for Honeywell's Series 700 valve line.

It has every other feature you need: easy adjustment of set point, positive overload protection, simple construction, quick reversibility, universal mounting; and best of all, the cost is surprisingly low.

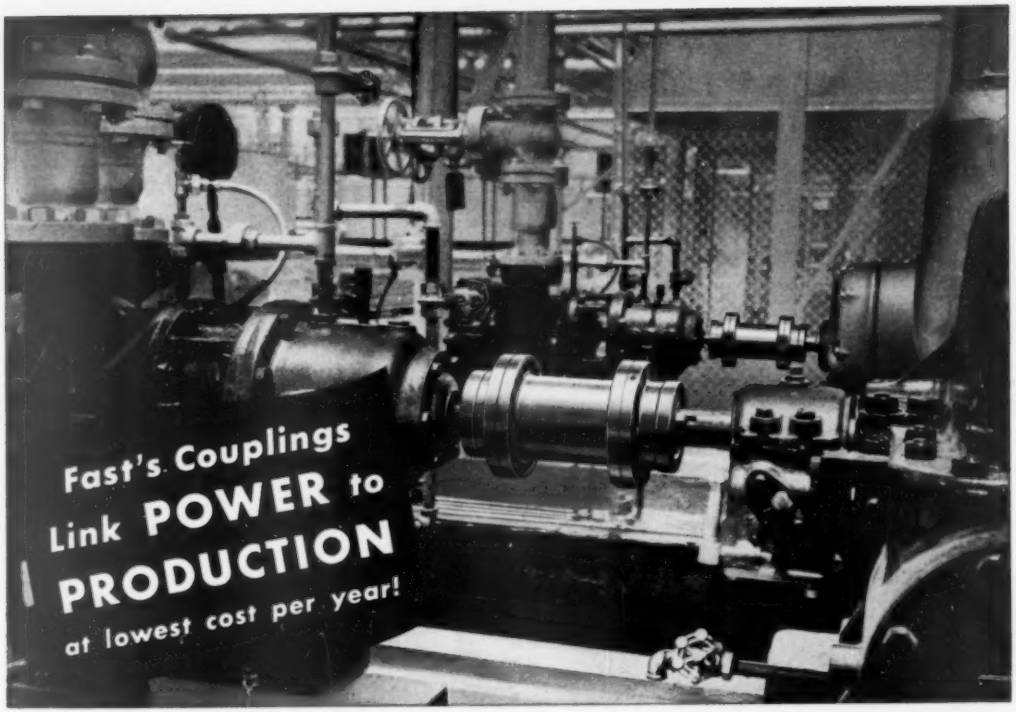
Our nearest engineering representative will be glad to demonstrate the Pressure Pilot for you right in your plant. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1906 Windrim Ave., Philadelphia 44, Pa.

Internal view at top shows arrangement of elements depicted in diagram. External view at bottom shows Pressure Pilot with door closed.

MINNEAPOLIS
Honeywell
VALVE PRODUCTS
First in Controls

● *Important Reference Data*
Write for new Bulletin 16-1, "Honeywell Pressure Pilot."



Every major producer of high-speed equipment uses FAST'S Couplings!

HIGH-SPEED equipment demands components with superior strength, accurate manufacture, long-lasting dependability. That's why it's important to *you* that Fast's Couplings are selected by every major high-speed equipment producer!

Fast s usually outlast the equipment they connect. Many have been in continuous operation for over 30 years, without trouble of any kind. And Fast's longer life saves you coupling dollars, too, because you amortize their cost over many years of trouble-free operation.

For full details on Fast's Couplings and Koppers Engineering Service, write today for your free copy of our catalog. Send to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.,* 381 Scott St., Baltimore 3, Maryland.

Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

KOPPERS

FAST'S
THE ORIGINAL
GEAR-TYPE
Couplings

INDUSTRY'S STANDARD FOR 32 YEARS

KOPPERS COMPANY, INC., *Fast's Coupling Dept.*
381 Scott St., Baltimore 3, Md.

Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

Name _____

Company _____

Address _____

City _____ *Zone* _____ *State* _____

Axelson "TLE" (Tubing Liner) Pump shown. There is an Axelson Deep Well Plunger Pump for every specific well condition.

Axelson *makes sure you get what you order!*

Knowing what to order is one thing, being sure you get what you order is quite another. The Axelson policy of rigid control and inspection at every stage of manufacture is centered in the laboratory. Here, deep well pump raw materials are subjected to exhaustive chemical and physical analysis including tests for tensile strength, hardness, impact, hot acid etch and fatigue. And when all these tests are concluded, tabulated and checked against each other, there can be no question about quality. Axelson leaves nothing to chance. This is why Axelson deep well pumps are giving maximum, trouble-free service in wells all over the world--and have been for many, many years. This is why it is--*AXELSON Chosen first...to last!*

Our 60th Year

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

Axelson

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whatever the
drilling mud problem...

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Sound basis for cat-cracking economy—

Elliott turbine-driven blower serving cat cracker at the modernized McMurrey Refinery, Tyler, Texas. The blower is rated 16,750 inlet cfm with a 25.5 psi pressure rise. The Elliott 1760-hp condensing steam turbine is direct-connected, operating at 6030 rpm.

ELLIOTT *Centrifugal* BLOWERS

The centrifugal air blower pictured above is typical of the many Elliott blowers now serving the oil industry. Similar blowers are handling hydro-carbon gases in the same refineries and are proving to be more reliable and less costly to maintain than displacement type compressors previously used for this service. Meeting the high reliability requirements of refinery service, Elliott blowers and compressors have aided in establishing several outstanding records for continuous performance of a refinery. They are recognized for their dependability and high availability. Since Elliott can furnish the driver as well as the blower or compressor, unified responsibility is a further advantage.

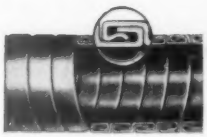
For details, contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

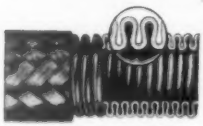
CENTRIFUGAL BLOWER DIVISION

P2-3a

Wherever petroleum products must be conveyed . . . . .



CMH convoluted hose is available in a variety of types including square locked, ball bearing and fully interlocked . . . in steel, bronze and other alloys. Sizes up to 12", I.D.



CMH corrugated steel and bronze hose is available in standard sizes from ½" through 12" I.D. for burst pressures to 12,000 psi, temperatures to 1000° F. Stainless steel types also available.

CMH

FLEXIBLE METAL HOSE makes the job easier!

AT THE well head, in transport or in the refinery, CMH Flexible Metal Hose can simplify handling petroleum products. Its high degree of flexibility combined with the rugged durability of metal makes it ideal for any connections that involve motion, vibration or misalignment. Used as vibration connections, as loading and unloading hose, as tank settling connections and in a score of similar applications, CMH Flexible Metal Hose provides the dependability so vital to the petroleum industry. Freedom from deterioration and resistance to wear and tear assures greater over-all economy.

Write for descriptive literature giving full information on CMH Flexible Metal Hose. There is no obligation.

Flexon identifies CMH products that have served industry for over 50 years.

CMH

CHICAGO METAL HOSE Division

Flexonics Corporation

1345 S. Third Avenue • Maywood, Illinois

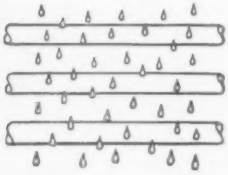
Manufacturers of Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems • Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Which condenser gives greatest sub-cooling?

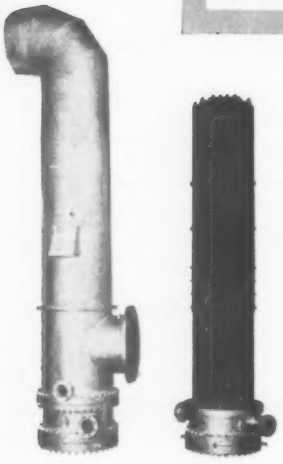
B

Diagram of one of the finned elements of a G-R G-Fin Vertical Condenser. Here, the drops of condensate are guided along the channels formed by each of the G-Fins, so that they are in constant contact with the tubes throughout their entire downward flow.



A

Diagram of part of a standard horizontal tubular condenser. Here, the drops of condensate hop, skip and jump down over the bare tubes, with only momentary contact at each tube.



These two diagrams show why the G-R G-Fin Vertical Condenser provides far greater sub-cooling effect than horizontal bare tube units for condensing hydrocarbon vapors.

One of the many other important features of this G-R design is that the absence of a floating head at the top of the unit permits unobstructed entrance of vapors. This feature makes the G-Fin Condenser the most economical design for high vacuum service.

Write for complete information on the design that provides exceptional compactness, low pressure drop, freedom from temperature strains, and prevention of condensate entrainment as well as superior results in high vacuum service and greatest sub-cooling effect.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

G-R HEAT TRANSFER APPARATUS

G-Fin Condenser

ONE OF THE MANY TYPES OF G-R HEAT TRANSFER APPARATUS

GR 200

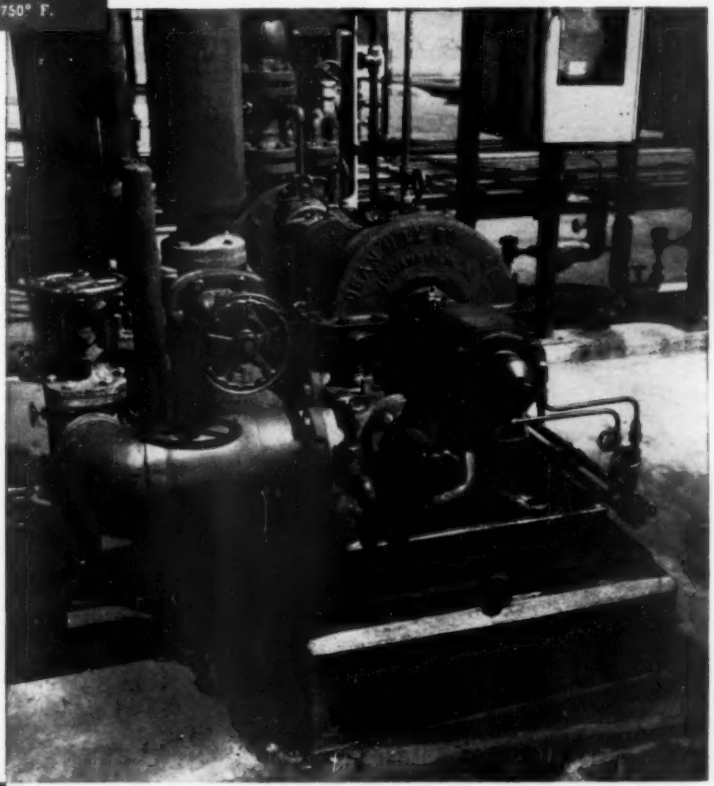
Designed with the operator in mind!

HORSEPOWER UP TO 1000
PRESSURES UP TO 875 LBS.-750° F.

No streamline housings.
No needless cover-ups.
Nothing fancy or frilly about these power-making huskies. Dean Hill Steam Turbines are designed and built for nothing but long service and easy, economical operation. Their heavy, rugged construction is simple and uncluttered for quick, easy maintenance. All pressure parts are outside and visible to operator.

DEAN HILL STEAM TURBINES

.....are single stage, double impact type for low steam consumption. Specifically designed for operation at medium steam pressures and temperatures, DH Turbines have all the advantages available under these conditions, including excellent water rates. Write us for further information and complete specifications.



One of eighty-four Dean Hill Steam Turbines recently installed in a large, eastern Refinery

DEAN DH HILL PUMP COMPANY

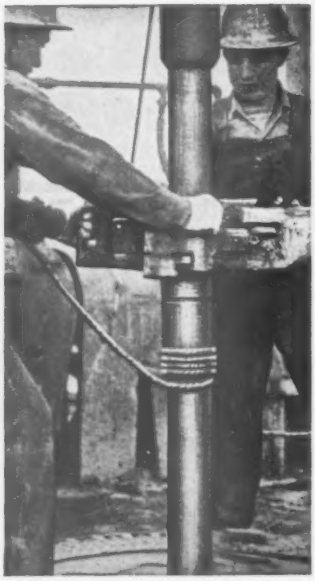
Pump and Turbine Engineers Since 1895

INDIANAPOLIS 7, INDIANA

SALES OFFICES IN:

Chicago • Mexico City • Philadelphia • Salt Lake City • New York • Dallas • New Orleans • San Francisco • Denver • Los Angeles • Pittsburgh • Houston • St. Paul • Cleveland

SPLIT-SECOND SUPERVISION. With G-E 2-way radio you're always "on the job." Today, when operations must be regulated in order to produce oil products economically, instant communication can mean increased profits for large and small operators alike.



CUT OPERATING COSTS. Shutdowns must be kept to a minimum. You can depend on G-E 2-way radio to do just that! An expensive operating rig out of action for 2 hours would pay for low cost of a G-E radio unit. How much would instant communication save you?

SPEED REPAIRS. Every hour lost waiting for repairs cuts down on your volume and your profits. With G-E 2-way radio communication in your maintenance operation, pipeline damage can be quickly spotted...speedily repaired.

ORDER EMERGENCY SUPPLIES. Instant communication over great distances speeds supplies, keeps the job rolling. With G-E 2-way radio you eliminate useless travel time and increase the efficiency of your entire operation.

Follow the oil industry leaders—

PLAN YOUR NEXT JOB WITH G-E 2-WAY RADIO COMMUNICATION

Ask the CAS* man in your local G-E office about G-E communications equipment designed for use in the oil industry. Or, write us direct: *General Electric Company, Section 83112-3, Electronics Park, Syracuse, N. Y.*

*Communications Advisory Service

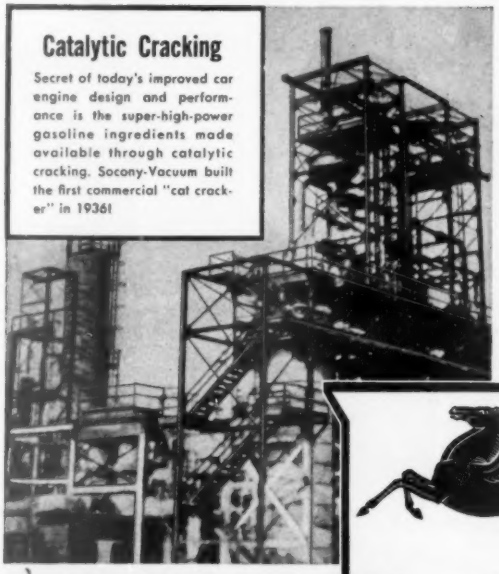
You can put your confidence in—

GENERAL ELECTRIC

Flying Red Horse "FIRSTS"

Catalytic Cracking

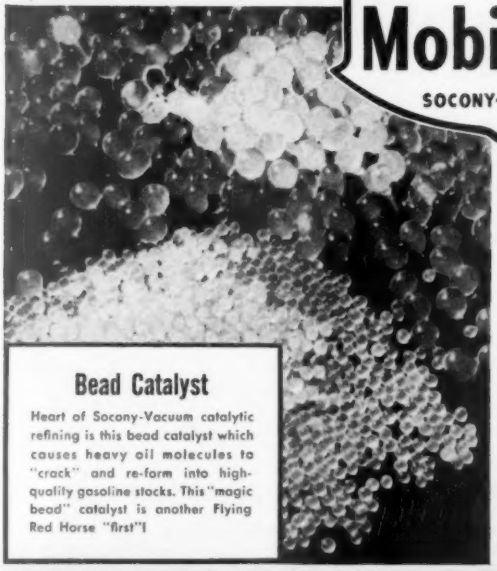
Secret of today's improved car engine design and performance is the super-high-power gasoline ingredients made available through catalytic cracking. Socony-Vacuum built the first commercial "cat cracker" in 1936!



TCC Refining

In 1943 the first commercial Thermofor Catalytic Cracking unit — using a *continuous* catalytic process — went into production. Created by Flying Red Horse research, this TCC process made possible greater quantities of high octane stocks and even better gasolines!

Mobilgas
SOCONY-VACUUM



Bead Catalyst

Heart of Socony-Vacuum catalytic refining is this bead catalyst which causes heavy oil molecules to "crack" and re-form into high-quality gasoline stocks. This "magic bead" catalyst is another Flying Red Horse "first"!

New Reforming Process

TCR — Thermal Catalytic Reforming Process — latest in catalytic processing — produces highest-quality blending stocks from low-quality material . . . assuring continued Flying Red Horse leadership!

SOCONY-VACUUM OIL COMPANY, INC.
and Affiliates:
MAGNOLIA PETROLEUM COMPANY • GENERAL PETROLEUM CORPORATION

SOCONY-VACUUM

Announcement

The Kerotest Manufacturing Company has become a wholly owned subsidiary of Tube Turns, Inc., Louisville, Ky., the nation's No. 1 producer of seamless welding fittings and flanges.

Kerotest will continue to operate under its own name. And it will continue to make the high quality steel and brass valves that have earned it an enviable reputation.

All current and future orders will be shipped as scheduled. Service and trade relationships will be improved.

Kerotest's present excellent position in the fields it serves will be further enhanced by the engineering, research, manufacturing and management resources of the parent company.

Kerotest's management and personnel have been largely retained. GEORGE O. BOOMER, *president* of Tube Turns, Inc., is now chairman of the board. JOHN G. SEILER, *executive vice president*, and ROBERT J. LANDOLT, *vice president and controller* of Tube Turns, Inc., have been appointed vice presidents. WALTER G. SWANEY, *vice president and secretary*, and J. D. ISAACKS, *vice president* of Kerotest, remain in the same capacities.

KEROTEST®

TUBE-TURN

KEROTEST MANUFACTURING COMPANY

A wholly owned subsidiary of TUBE TURNS, INC., Louisville, Kentucky

PITTSBURGH 22, PA.

NEW YORK · PITTSBURGH · CHICAGO · HOUSTON · TULSA · ODESSA, TEX.
LOS ANGELES · CHARLESTON, W. VA. · RICHMOND, VA.

USE THESE BETTER

Vogt Products

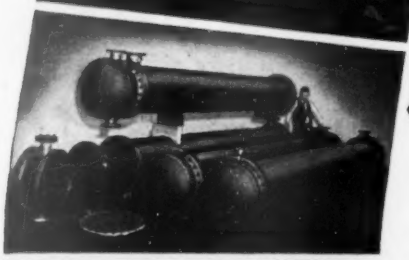
For Today's Tough Service Demands

EFFICIENT AND DEPENDABLE STEAM GENERATION

Vogt steam generating units are designed to give maximum rating in a minimum of space with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels, as desired, meet every power, heating or process requirement.

PROCESS EQUIPMENT FOR EVERY SERVICE

Stills, towers, oil chilling machines, filter presses, heat exchangers, etc. are constructed to all Codes. They meet all demands for operating security and trouble-free performance and help to lower costs in important process industries around the world.

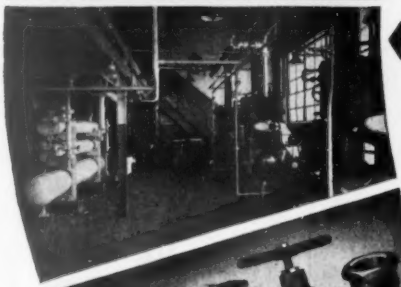


SPECIAL MATERIALS FIGHT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment made from special metals and alloys to combat corrosion, and product contamination or discoloration. Fabrication procedures employed insure that corrosion resistant properties of welds will match that of the materials from which units are constructed.

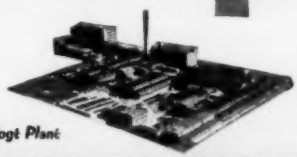
MORE TONNAGE AT LESS COST

Over 60 years of manufacturing experience, engineering and research stand behind Vogt refrigerating and ice making machinery. Absorption Systems, Compression Systems, and the Automatic Tube-Ice Machine in a wide range of capacities serve in leading petroleum refineries, chemical plants, ice and cold storage plants, dairies, packing plants, etc., at home and abroad.



DROP FORGED FOR EXTRA TOUGHNESS AND LONG-TIME SERVICE

Vogt valves, fittings and flanges, for top performance in oil, water, air, gas, and ammonia services, at high or low pressures and temperatures, are available drop forged entirely from carbon steel or stainless steel. Valves can be furnished in a combination of materials by using stainless steel for parts affected by service temperature or corrosion, and less expensive alloys or carbon steel for other parts.



Air View of Vogt Plant

HENRY VOGT MACHINE CO.

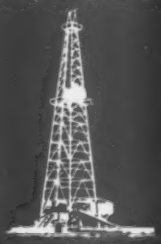
LOUISVILLE 10, KENTUCKY

BRANCH OFFICES NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS

Mining Facilities

SERVICE...

Service Facilities



Laboratory Facilities

AROUND THE CLOCK
...THROUGHOUT
THE OIL FIELDS

Dealer Facilities

SO . . . when you need dependable mud service

Call Magcobar first. There's an experienced and reliable Magcobar Dealer near you with a complete stock of field proved drilling muds and chemicals. And to assist you when the going gets tough, there's the Magcobar mud engineer, an expert in mud and an expert in the kind of country where you're drilling. You'll find that your Magcobar Dealer and mud engineer are on your team all the way to completion.

ONE OF THE DRESSER INDUSTRIES

Magcobar

Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION • MALVERN, ARKANSAS • HOUSTON, TEXAS

They Say—

Oil Needs Protection

"We think that Russia's producing capacity amounts to about 15 per cent of this country's production, or 1,000,000 bbl. daily. There are 2,000,000 bbl. per day in the existing production in the Middle East, with much more available. Do you think it is important to hold this? It certainly would be vital to deny it to an enemy.

"Most foreign countries support their search for oil through government subsidies. We have to go it alone.

"I say, think of this before you imperil this civilization. Your youngsters' lives depend upon a defense program that includes protection of this vital source of power."

Dwight T. Colley, vice president of Atlantic Refining Co., speaking in Philadelphia.

Crux of the Iranian Problem

"The real problem of Anglo-Iranian agreement is not the presence or absence of accredited diplomats of the two countries in London and Teheran. If such an agreement should become possible, it could be arranged through a third party.

"Nor can Mossadegh hope that his gesture will, of itself, have any effect upon British economic pressure on Iran or solve the internal problems of that country.

"The crux of the question is the fact that the Iranian government has shown no disposition to pay any compensation for the properties it has sequestered, but, instead, demands that the British pay a premium for being despoiled. Most of the other issues have been disposed of by British concessions.

"It is hard to see how the British government can go farther; certainly there is no indication in the most recent British note of a willingness to do so."

Editorial in the New York Herald-Tribune.

The True Security

"The real source of economic security is our technology—our system of industrial production. Our standard of living, to a considerable extent our agriculture, even our cultural institutions, depend upon the wealth we create by the use of our technology.

"Social Security illustrates and proves that our technology produces sufficient wealth not only to support those who produce but also to help those who do not. Only great wealth permits pensions, vacations, and the fringe benefits in which organized labor takes so great an interest.

"The concept is true in government itself for, as I said, government produces no wealth but can only take what others produce and distribute it. Too many people, however, regard all of these as blessings from a paternalistic government, when of course they are nothing of the sort!"

William H. Ward, vice president of E. I. du Pont de Nemours & Co., addressing the Paint, Varnish, and Lacquer Association, Cleveland.

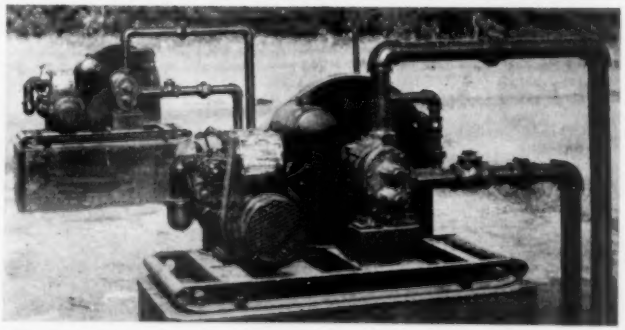
What Crude-Oil Costs

Sir:

"With reference to your article on page 76 of the October 20 issue which was based upon recent report by us on the cost of increasing oil production, we would like to make the following comment.

"The expenditure figures were based on reported capital expenditures plus costs of dry holes. Our figures, while presenting a general indication of oil-finding costs, did not include any provision for geological, geophysical, land department, lease rental, and general overhead expense. For the period

All-Weather Oil Treating PUMPING UNITS



The above pumping units are powered by WISCONSIN *Air-Cooled* Engines for circulating oil and tank bottoms

Slow speed of pump eliminates internal agitation and remulsification. Pump is self-priming, positive and has high suction lift. High tension rotary magneto with impulse starter insures easy engine starting at lowest temperatures.

No fan belts, radiators or water pump problems when using WISCONSIN Air-Cooled Engines.

For all types of recycling and transfer tank bottom units in the 2½ to 30 H.P. range, consult us.

HARLEY SALES CO.

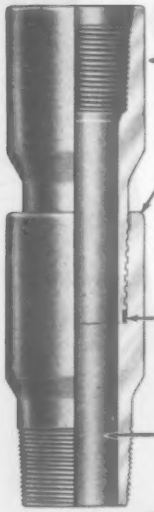
OIL FIELD DISTRIBUTOR

M & M Bldg. **HOUSTON**

Box 1259 **TULSA**

505 S. Main St. **WICHITA**

Here's the key to a "Free" TUBING STRING


SAME O. D. AS TUBING COUPLING
LEFT-HAND SQUARE THREADS RELEASE EASILY AND POSITIVELY
OIL-RESISTANT THREAD SEAL
"FULL-BORE" SAME I. D. AS TUBING

You need never worry about freeing your tubing from packers and other devices that sometimes freeze in the hole after prolonged periods of use—not if you've taken the precaution to install a Baker Safety Joint strategically in your tubing string.

BAKER SAFETY JOINT

A few turns to the right unscrews the Baker Safety Joint, freeing your tubing quickly and easily. And you just don't worry about the Baker Safety Joint ever freezing or sticking. It is especially designed to unscrew easily even after long periods of sub-surface exposure.

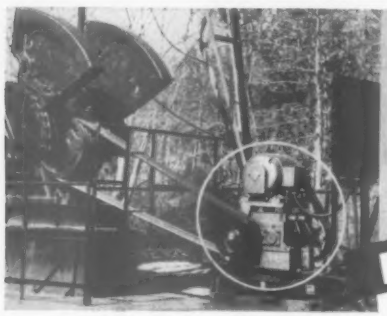
Precision-matched *left-hand* square threads are of the exact tolerance and taper to ensure positive breaking of the joint. The tough, oil-resistant thread seal effectively protects these threads from corrosive fluids.

YOUR SUPPLY STORE has BAKER SAFETY JOINTS in stock, or will get them for you promptly.

PRODUCT NO. 441

BAKER OIL TOOLS, INC.

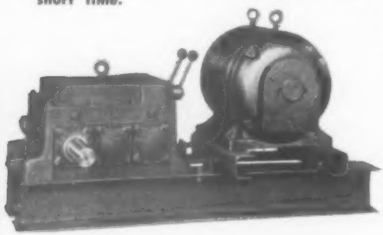
HOUSTON • LOS ANGELES • NEW YORK



A TURNER TRANSMISSION makes your single reduction pumping units... FLEXIBLE!

- Four speed selection
- Reduce peak loads (lower power costs).
- Turner transmissions are NOT expensive ... they pay for themselves in a short time.

Since the introduction of the new Turner Transmission, we've been loaded with orders... especially by owners of single reduction units. Whether powered by gas, gasoline or electric motor, the Turner Oil Field Transmission offers flexibility and efficiency. Electrifying? Pump as slow as necessary with the Turner Transmission... it's just like putting a throttle on an electric motor. Write for specifications today...



TURNER UNI-DRIVE Company

3416 Terrace Street Kansas City 8, Missouri

under review, these additional changes would approximate $2,000,000,000, bringing the total of all expenditures up to $9,757,000,000 or approximately $4,000 for each daily barrel of oil production."

H. T. Johnson, Jr.
John S. Herold, Inc.
New York.

Texan's View of the Tidelands

"Governor Stevenson's idea of a 'fair solution' of the tidelands controversy is to take away the oil owned by Texas and the other coastal states and divide up the proceeds among all the states. That is like trying to put the odor of sanctity upon robbery by saying that the stolen money will be put to good use."

Editorial in the Fort Worth Star-Telegram.

Tidelands and Taft-Hartley

"In Governor Stevenson's view, when the Supreme Court rules, as it has in the tidelands case, it is the sacred duty of all of us to accept that ruling. We can't have it both ways, he says. We can't be for the Supreme Court on Monday and against it on Tuesday.

"Well, does Governor Stevenson abide by his own dictum? The Supreme Court has ruled that Texas does not own its tidelands. Governor Stevenson believes we should accept that ruling and do nothing about it. The Supreme Court also has upheld the Taft-Hartley law. Yet Governor Stevenson is not willing to accept that. He is going about demanding that the Taft-Hartley law be repealed."

Editorial in the Fort Worth Star-Telegram.

CALENDAR

NOV.

5- 7 Industrial Management Society, 16th annual time and motion study and management clinic, Sheraton Hotel, Chicago.

6- 7 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6- 8 Gulf Coast Association of Geological Societies, annual fall meeting, Hotel Driscoll, Corpus Christi, Tex.

8-13 Oil Industry Information Committee, Conrad Hilton Hotel, Chicago.

10-13 American Petroleum Institute, thirty-second annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

13-14 Society of Exploration Geophysicists, midwestern meeting, Texas Hotel, Fort Worth.

17-18 American Institute of Electrical Engineers, subcommittee on electrically operated recording and controlling instruments, technical conference, Benjamin Franklin Hotel, Philadelphia.

HOW *Much* CAN YOU SAVE BY USING **TRIANGLE** PLASTIC PIPE?

CONSIDER THESE *Facts*

When buying pipe for:

- **SOUR CRUDES**
- **PARAFFIN CRUDES**
- **BRINE**

1 **IT IS LIGHT.** Triangle Semi-Rigid Pipe has a weight factor approximately ⅛ that of ordinary pipe.

This means—extreme ease of handling, saving of money on transporting pipe to the job plus savings on the job. One man can easily carry three 20-foot lengths.

2 **IT WON'T CLOG.** Its smooth walls prohibit the build up of paraffin or asphalt.

This means—a pipe that doesn't deteriorate in value. You can use and re-use Triangle Semi-Rigid Plastic Pipe.

3 **RESISTS RUST & CORROSION.** Triangle Semi-Rigid Plastic Pipe cannot rust, and is not affected by corrosion or electrolytic action.

This means—longer pipe life. In addition, the pipe is 100% salvable.

4 **EASY COUPLING.** Couplings and fittings are joined to the pipe with a rapid sealing cement which is easy to apply with a paint brush and gains full strength in a matter of minutes.

This means—stringing fast runs are the usual procedure. For temporary installations, removal is made by cutting with an ordinary hand saw.

5 **FOLLOWS CONTOURS.** Triangle Semi-Rigid is flexible enough to follow ditching contours. Its impact strength is such as to eliminate special care in back filling.

This means—no need for precise straight-line finishing of ditches. Connections can be made above ground.

Whether you want Flexible, Semi-Rigid or Rigid Plastic Pipe, ask your distributor for Triangle.

Write for new booklet.

PLASTIC PRODUCTS
Division
TRIANGLE
CONDUIT & CABLE CO., INC.
New Brunswick, New Jersey

TRIANGLE — *It Must Be Right*

Built for a Long Life . . . Backed for a Lifetime

68

TODAY, Twin Disc can point to *more Friction Power Take-Offs*—in more sizes and in more fields of application—than any other manufacturer.

Why? Partly because Twin Disc Friction Power Take-Offs offer unparalleled *performance* and *durability*—and because they are available in a full range of sizes.

There's another reason—a very important reason. Twin Disc PTO's are not only built for a long life . . . but they're *backed for a lifetime*, with the fastest, largest, and most thorough industrial friction and hydraulic drive Repair Parts Service available to industry. Sixty Twin Disc Parts Stations and eight Factory Branches—maintain a circulating inventory of $3¼ million in strictly repair parts and replacement units.

Strategically located Factory Branches and Parts Stations maintain a constant $3¼ million parts and replacement unit inventory.

That's why Twin Disc is recognized throughout industry as the most dependable source of Industrial Friction and Fluid Drives.

Ask for Bulletin No. 129C, which gives complete information on Twin Disc Friction Power Take-Offs. And if you've misplaced your Twin Disc PTO General Instruction Book, ask for another. Write to Twin Disc Clutch Company, Racine, Wis.

Twin Disc PTO sizes range from single-plate 6.5" to 24" double-plate, 11.5" to 24". Housing sizes No. 6 SAE to No. 00 SAE. Capacities up to 650 hp.

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

BRANCHES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • SEATTLE • TULSA

20-21 National Association of Corrosion Engineers, western region, second annual corrosion conference, Biltmore Hotel, Los Angeles.

20-22 Instrument Maintenance Short Course, jointly sponsored by Southern California Meter Association and Los Angeles Harbor Junior College.

21 Natural Gasoline Association of America, district meeting, Herring Hotel, Amarillo, Tex.

30-Dec. 5 American Society of Mechanical Engineers, Statler Hotel, New York City.

DEC.

1- 3 New Mexico Oil and Gas Association, annual meeting, Albuquerque.

1-6 American Society of Mechanical Engineers, twentieth National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York.

4- 6 American Chemical Society, southwest regional meeting, Little Rock, Ark.

5- 6 Interstate Oil Compact Commission, winter meeting, Wichita, Kans.

7-10 American Institute of Chemical Engineers, annual meeting, Hotel Cleveland (Hqs.) and Carter Hotel, Cleveland.

1953

JAN.

19-22 Plant Maintenance Conference, Public Auditorium, Cleveland.

FEB.

2- 4 Missouri Petroleum Association convention, President Hotel, St. Louis.

2-6 Corrosion short course, sponsored by National Association of Corrosion Engineers, University of California, Berkeley.

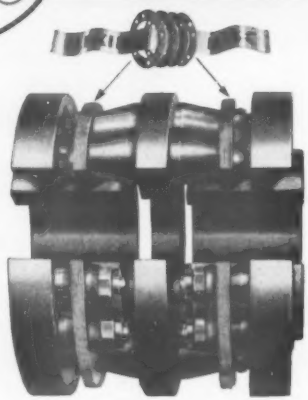
AVOID COSTLY SHUT-DOWNS!

prolong the life of your machines with Thomas Couplings

NO MAINTENANCE
NO LUBRICATION
NO BACKLASH
NO WEARING PARTS

THOMAS

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

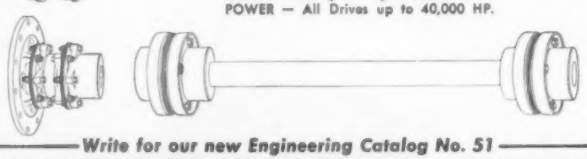


REFINERS! PIPE LINE MEN! DRILLING ENGINEERS! LABORATORY TECHNICIANS!

You can use Thomas Couplings to your advantage on Pumps, Compressors, Cooling Towers, Rigs or any tough job where continuous operation and dependability are required.

Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

SPEEDS — All Speeds up to 30,000 RPM.
POWER — All Drives up to 40,000 HP.



Write for our new Engineering Catalog No. 51

THOMAS FLEXIBLE COUPLING COMPANY
WARREN, PENNSYLVANIA, U.S.A.

15-19 American Institute of Mining and Metallurgical Engineers, annual joint meeting of petroleum, metals, and mining branches, Statler Hotel, Los Angeles.

27 Natural Gasoline Association of America, regional meeting, Scharbauer Hotel, Midland, Tex.

MARCH

2- 6 American Society for Testing Materials, spring meeting, Statler Hotel, Detroit.

4- 6 American Petroleum Institute, division of production, Southwestern district spring meeting, Hilton Hotel, Fort Worth.

8-11 American Institute of Chemical Engineers, Buena Vista Hotel, Biloxi, Miss.

15-17 American Petroleum Institute, division of production, Eastern district spring meeting, William Penn Hotel, Pittsburgh.

16-20 National Association of Corrosion Engineers, ninth annual conference and exhibition, Hotel Sherman, Chicago.

18-20 American Petroleum Institute, division of production, Mid-Continent district meeting Mayo Hotel, Tulsa.

23-25 Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, Tex.

23-26 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists, annual meeting, Rice and Shamrock Hotels, Houston.

30-31 Texas Independent Producers and Royalty Owners Association, annual meeting, San Antonio.

30-Apr. 1 Mid-West Gas Association, Broadmoor Hotel, Colorado Springs, Colo

APR.

8-10 American Petroleum Institute, division of production, Eastern district meeting, William Penn Hotel, Pittsburgh.

15-17 National Petroleum Association, midyear meeting, Cleveland.

21-23 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

24-25 Interstate Oil Compact Commission, 1953 spring meeting, Roosevelt Hotel, New Orleans.

26-29 American Institute of Chemical Engineers, Chemical Institute of Canada, joint meeting, Royal York Hotel, Toronto, Ont.

27-28 Independent Petroleum Association of America, mid-year meeting, Jefferson Hotel, St. Louis.

Apr. 29-May 1 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

MAY

4- 5 American Petroleum Institute, division of marketing, midyear meeting, Baker Hotel, Dallas.

7-8 American Petroleum Institute, Rocky Mountain district, Division of Production, spring meeting, Gladstone Hotel, Casper.

11-13 Southern Gas Association, Jung Hotel, Hotel, New Orleans.

14-23 International Petroleum Exposition, Tulsa.

24-27 American Gas Association, production and chemical conference, Hotel New Yorker, New York City.

28-29 Natural Gas and Petroleum Association of Canada, London, Ont.

CUSHION GRIP

. . . that never fails

MISSION
rolling dog rotary slips

The cushion grip of the exclusive Mission rolling dog principle insures a positive INSTANT GRIP . . . a smooth, INSTANT RELEASE. Thus, Mission Rolling Dog Rotary Slips never cut or "bamboo" your pipe. Mission Rolling Dog Rotary Slips are faster and easier to handle, easier to service. Specify MISSION when you buy rotary slips through your Supply Store for any size or length strings.

MISSION MANUFACTURING CO.

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Streamlining has made the Lee C. Moore Masts distinctive. More important, is the fact that the Moore streamline design makes the mast easier to transport, erect and use. There are no surplus braces or parts. Every piece has an important part to play in making these masts sturdy and efficient.

LEE C. Moore

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THE OIL AND GAS
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JOURNALLY Speaking

Slick Deal

ONE reason why there is so much interest in petrochemicals is that a very neat (gross) profit can be made out of these oil fractions if you know how to juggle them around properly. For instance, there's polytetrafluorethylene, a kind of paint that is made from ethylene, which a refinery will sell you for about 4½ cents a pound. The paint retails at $75 per gallon—a return of 15,000 or 20,000 per cent.

Not bad, and all you have to do is revamp the ethylene by sticking fluorine atoms on where hydrogen atoms were originally and then polymerize the whole brew. However, we are advised that there are a few tricks to the process, and it's not a business for amateurs.

The reason this paint brings such a fancy price is that nothing will stick to it, so it finds a ready, though limited, market on industrial machinery handling gooey things like candy, dough, glue, and rubber. Unfortunately it has to be baked on, so isn't suitable for nursery walls.

What's in a Name?

ONE of our secret operatives has run down for us some inside information about Whale Oil Co., Inc., a big fuel-oil distributor in New York, simply to satisfy our personal curiosity as to the origin of the name. We had wondered whether it was owned by a Mr. Whale, or perhaps actually was in the business of selling whale oil nearly a century ago when "coal oil" from petroleum began to cut into the illuminating market.

Both guesses proved wrong. It develops that the name was deliberately chosen by the organizers, none of whom was named Whale or even Fish, partly because it was unusual and distinctive, partly because it implied a "whale" of a bargain, and partly because one of the organizers had ancestors engaged in Arctic whaling in the middle of the last century.

The choice apparently was a good one, for the company seems to be doing a whale of a business. Now and then, we are informed, the company does get inquiries for buying or selling oil from whales, and requests for information from high-school students preparing essays on whaling. This is not surprising, although a little reflection should suggest that oil-company names can be quite deceiving if taken literally. For example, does anyone infer that Shell Oil Co. produces oil from shells, Sun Oil Co. from solar energy, or Lion Oil Co. from the king of the jungle?

This discourse on company names which don't mean precisely what they seem to imply could be carried even further. For instance there is a Major Oil Co. in Oklahoma which is far from being a major oil company (though it probably hopes to be some day) and Marine Oil Co. operates in Arkansas, far from any ocean.

Which reminds us that we once asked an official of Pure Oil Co. if the company had to take much kidding about its name. He said yes and the company didn't mind, but none of the modern punning equaled the old favorite about the Texas preacher who said "God bless the pure and humble," only to hear somebody pipe up from the back row, "What's wrong with Gulf and Magnolia?"

Oil Musical

LOTS of books and not a few movies have been produced about the early days of oil and the boom towns spawned by new discoveries. Now this theme is about to be the basis for a musical comedy, adapted from the new book "Spindletop."

Many present-day oil men look askance at fictionized accounts of the oil plays of a generation or more ago on the ground that they overstress the glamor and excitement, wickedness and recklessness which sometimes accompanied these booms and give people the idea that the oil industry is still like that, which of course it isn't. But this complaint will be overlooked if the Spindletop musical turns out tunes as good as those of "Oklahoma!" which is based, tenuously, on some not-too-savory incidents in the history of the state of that name.

—Henry D. Ralph

In a nutshell–here's the story

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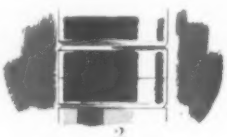

2

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AP-509

How to build up oil reserves for defense

OIL producers' present concern over prices and imports is caused chiefly by the Government's defense programs. The word is programs rather than program, because the Government has a variety of programs and they are not coordinated. The oil industry is caught in the middle of cross fire and cross purposes.

One program is to build up a reserve crude-oil producing capacity in the United States. This is a wise program, and the industry is ready and willing to carry it out—provided it is not penalized for its efforts.

Another program is to keep down consumers' prices in order to prevent (or conceal) inflation. This threatens to deprive oil producers of the funds needed to develop and carry idle standby capacity.

Other programs encourage American firms to develop foreign oil; allocate steel among many domestic and foreign users; aid friendly nations by increasing their foreign trade and expanding their industries. Still other federal agencies, unconcerned with defense, accuse the oil industry of monopolistic and cartel practices for following some of the defense programs.

IF defense is our main job, and if oil is vital to defense, and if a domestic reserve capacity is essential to the program, then all concerned should help achieve this objective.

One simple fact should be obvious: Somebody has to pay a lot of money to build up and carry reserve oil-producing capacity. Producers are willing to finance the program themselves if they can get enough funds from the sale of oil they do produce to carry their investment in unused facilities.

In addition to an adequate price per barrel, producers need assurance of a large enough market to give them the needed income. This means holding imports to some reasonable proportion of the domestic consumption, say about the same ratio as in recent years.

Other essentials of this program are a fair allocation of steel between domestic and foreign producers, assurance that foreign producers will share in the reserve program by keeping production below capacity, and freedom from harassment and prosecution for doing what the defense planners ask.

THIS is a reasonable program and it doesn't require any world-wide cartel or international control machinery. It can be achieved by a clear understanding of objectives and methods, and genuine cooperation among all elements of the oil industry and the federal Government.

The administration should make up its mind whether or not a reserve domestic crude-producing capacity is the paramount objective. If so, all federal agencies should shape their policies toward this end. Then the oil industry will provide that capacity on schedule and at reasonable cost.

better guide to more oil?

LOOK TO

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FOR SERVICE EXTRAS

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FOR OIL INDUSTRY CHEMICAL SERVICE

THIS WEEK

OIL-BUILT CITY is New Talara, Peru, now 6 years old and still growing. One of the most modern towns in South America, it is being built by International Petroleum Co., Ltd., to house 40,000 people. By the end of this year about $10,000,000 will have been spent. Ultimately the expenditure will total $20,000,000. To date, 1,503 two and three-bedroom houses for workers have been erected. Other structures include 117 staff houses, a church, clinic, staff club, market, ice and cold-storage plant, and shops, warehouses, and garage facilities. Construction is all concrete and brick. International is now trying to open the city to the public by selling land for public buildings and business enterprises. It also hopes to develop some plan permitting home ownership by employes.

INTERNATIONAL.—President of Bechtel Corp. proposes fabulous natural-gas system capable of moving a billion cubic feet daily from Iraq fields to Paris and western Europe. . . . Magnitude of this undertaking would exceed anything yet built in the pipe-line field in the United States or abroad. . . . ¶Petroleum Committee of International Labor Organization proposes study of present working hours in international petroleum industry. . . . ¶Trinidad Bank offers $3,250,000 loan to Cosden Petroleum Corp., which is considering construction of modern new refinery on the island. . . .

IMPORTS.—I.P.A.A. concludes United States by 1955 could produce enough crude to meet all domestic needs without dependence upon imports. . . . Forecast says producing capacity will reach 9,600,000 bbl. daily by 1955, 12,000,000 bbl. daily by 1960. . . . Greatest threat in imports is from Western Hemisphere countries, report concludes. . . .

NATURAL GAS.—Although reserves of natural gas indicate a supply for many years, the gas industry must continue studies of developments in coal gasification, gas synthesis against the time when economic supplies of natural gas are no longer available, A.G.A. told. . . . ¶Gas-utility industry warned to get out and push its product, promote research, and win the public's confidence. . . .

PRODUCTION.—Carbon dioxide in flood water will result in a higher oil recovery than plain water, Penn State technical conference told. . . . Research technologist says tests indicate better results than other water flood or gas-drive recovery methods. . . . ¶Rank wildcat in Delaware basin, well west of existing production, indicates major oil discovery. . . . Test is in Lea County, New Mexico. . . . ¶Another rank wildcat, this one in North Park basin, flows at a rate exceeding 1,500 bbl. daily, indicating Colorado's biggest oil well and the biggest this year in the Rocky Mountains. . . .

REFINING.—Humble let contract for world's largest solvent-deasphalting plant, to be built at Baytown, Tex. . . . Charge capacity will be 28,000 bbl. daily. . . . ¶Benzene made from oil will continue to find a market as supplement for lower priced supply from coal tar, but cheaper substitutes from chemical uses may curtail demand, Monsanto officials tells South Texas section of A.I.Ch.E. . . .

TRENDS.—The first decrease for the season in stocks of four major products was reported for week ended October 25, down 974,000 bbl. . . . The first decrease last year came for week ended November 3. . . . ¶Distillate was the only major product with a gain in stocks for October 25, up 1,071,000 bbl. . . . ¶Gasoline dropped 1,235,000 bbl., contrary to the upward trend since August 16. . . .

ACTIVITY.—Production of crude and lease condensate averaged 6,539,725 bbl. daily for week ended October 25, up 13,925 bbl. daily. . . . ¶Total well completions gained 67 wells for the week to 868. . . . Wildcat completions totaled 222 compared with 187 for previous week and 230 for corresponding week last year. . . . ¶Rotary rigs operating in United States dropped 8 rigs for week ended October 27 to 2,569 or 318 less than last year. . . .

CO_2 Flood Recommended

Results of research work justify field trial of novel secondary-recovery method, Penn State conference told

Kenneth B. Barnes

STATE COLLEGE, Pa.—The use of a carbon dioxide solution in waterflood operations will yield a higher recovery of oil than plain water, it is indicated by extensive laboratory tests on cores conducted by the Pennsylvania Grade Crude Oil Association.

The favorable results of a year's test program of CO_2 in water flood was disclosed at the Sixteenth Technical Conference on Petroleum Production of Pennsylvania State College here October 22-24.

The research was conducted by the Penn Grade association's laboratory at Bradford, Pa., and the results were described in three papers presented by members of the research staff: Dr. J. N. Breston, director, and R. M. Mcfarlane, W. E. Johnson, and D. C. Neil. Summarizing the results, Breston said:

"Although there are still several things we do not know about its mechanism, we believe we have learned that it works. We have determined to our satisfaction that carbon dioxide will recover additional oil from core samples when used in the flood water of either secondary or tertiary recovery operations. We have also determined that it works better than any other water-flood or gas-drive recovery method tested in our laboratory."

These new and favorable CO_2 tests are in direct contrast with those reported by the same laboratory at the same Penn State gathering a year ago. Then, preliminary test data on only one long core test each of Bradford and Venango sands indicated that carbonated water had no advantage in recovering oil *(The Oil and Gas Journal, November 1, 1951, page 29)*.

Field trial recommended . . . The more recent laboratory work was much more extensive and reversed the indications of the preliminary tests. They are so favorable, in fact, that Breston recommended trial in an actual water flood in the field. He said:

"The data on fresh core samples show that an average of 31.7 per cent of the oil in place after thorough water flooding can be recovered by carbonated water flooding. The extremes were as low as 19.5 per cent and as high as 47.4 per cent for groups of core samples from any particular well.

"If the sand has not been water flooded thoroughly the recovery might be a little higher, or about 34 per cent. Of course, these figures are all based on the assumption that full carbonation of the reservoir fluids will be attained, that is, at least 720 psig. carbonation pressure.

"Data from these experiments indicate that except for some additional investigations into the use of adjuvants, the process is ready for a controlled field experiment. This should not be just another trial, but a real test in an area which, on a basis of controlled flood-pot tests, shows some reasonable prospects of enough oil recovery to be considered practical."

Test results . . . Some of the results of the carbon dioxide flood tests described in the three papers were:

. . . When fresh field core samples, resaturated samples, and a long core of oil sand were flooded with carbonated water after depletion by brine floods, all produced an appreciable amount of additional oil.

. . . In flooding core samples with carbonated water, a higher percentage of carbonation resulted in greater oil recovery.

. . . The oil produced from the core samples by carbonated water flooding was always expanded, due to the dissolved carbon dioxide.

. . . Actual oil production was usually greater than that which can be explained on a basis of oil volume expansion.

. . . Resaturated samples responded to carbonated water flooding as well as or better than the samples did when they contained their original reservoir fluids.

. . . Flooding of fresh core samples with liquid carbon dioxide resulted in a considerable reduction in oil saturation. Recovery could be obtained with liquid carbon dioxide even after the samples had been flooded previously with carbonated water.

. . . Flooding a long core (Venango sand) with carbonated water after depletion by fresh water flooding also resulted in a reduction in oil saturation.

. . . During a carbonated water flood on the long core, only 7 per cent of the carbon dioxide gas could not be accounted for by carbon dioxide dissolved in the produced fluids or in the fluids in the core.

Conclusions . . . Some of the important conclusions arrived at as a result of the research work were these:

. . . Response to carbonated water flooding is adversely affected by age of the samples even though they have been kept in containers which seemed air tight.

. . . It appears that previous flooding with brine in the laboratory does not noticeably affect a core sample's susceptibility to carbonated water flooding.

. . . For both fresh and resaturated cores, oil recovery by carbonated water flooding apparently is related to initial oil saturation.

. . . The obvious advantage in using carbonated fresh water is that it holds more carbon dioxide in solution than brine (5.5 per cent vs. 4.24 per cent at 720 psig. and 75° F.) This makes the ultimate oil recovery possible with fewer pore volumes of flooding medium.

. . . The number of pore volumes of carbonated water necessary to achieve ultimate recovery from the fresh radial core samples varied from 60 to 550 with an arithmetic average of 173 pore volumes; half of the samples required 125 pore volumes or less for ultimate recovery.

The resaturated cores required an average of 82 pore volumes of carbonated water for ultimate recovery.

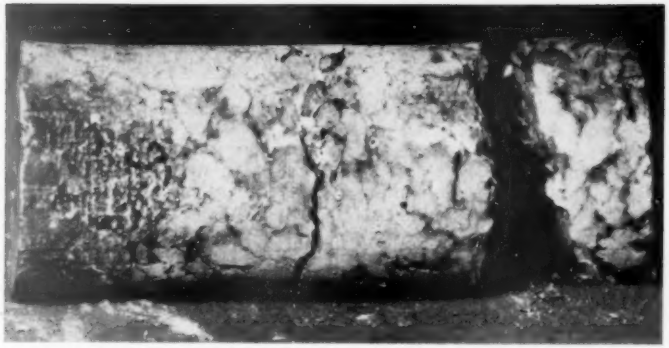
Oil by "Shock"?

Electric current through sands may raise output

STATE COLLEGE, Pa.—Future possibilities of increasing oil production by passing electric currents through the oil sand may be envisioned from experiments at the Petroleum and Natural Gas Department of Penn State College.

Prof. C. M. Davis told the college's Technical Conference on Oil Production that charges of electricity have fractured cores of the Canyon reef lime from Scurry County, Texas, and can heat the cores enough to produce liquid hydrocarbons and gases.

"Breakthrough" causes fractures . . . The Penn State experiments found that high voltage causes a small amount of current to flow through a core, causing the core suddenly to change from high resistance to low resistance, after



ELECTRICALLY FRACTURED CORE is this one taken from the Scurry County, Texas, Canyon Reef. It was fractured by a technique developed by Prof. C. M. Davis, of Penn State College. The "breaks" were obtained in 4 to 5 seconds' exposure via pin-point electrodes on 4-in. spacings, at 17,000 volts.

which much more current can be put through it at greatly reduced voltage.

This "breakthrough" of the current causes the core to fracture, thus suggesting the possibilities of using electrical methods to increase the permeability of oil reservoirs.

Good conductor . . . It has been observed that a carbon path is formed in the core by localized decomposition of hydrocarbon material, forming a conducting medium for the current. Initial application of the current vaporizes water in the core and breaks the circuit intermittently, and the resulting surges of electricity cause fracturing of the rock.

Cores with high brine saturations, about 75 per cent water and 25 per cent oil, are good conductors until the water begins to evaporate under the electrical heat, but the breakthrough and attendant fracturing is easiest in a system containing something over 50 per cent oil saturation.

Wetting Agents Studied

Reservoir characteristics hold key to success or failure of surface-active agents in flooding, technical group told

STATE COLLEGE, Pa. — Successful use of surface-active or "wetting" agents in water-flooding for increased oil recovery requires knowledge of whether the reservoir is a water-wet or an oil-wet system, the Penn State technical conference was told by researchers of Atlantic Refining Co.'s Dallas laboratories.

The report threw new light on the conditions under which wetting agents added to flood waters prove successful or unsuccessful. The report was presented by Dr. Thomas F. Moore and Dr. Harold A. Blum of Atlantic's staff. Their basic conclusions were:

1. From both theoretical and experimental considerations, no increase in oil recovery should be expected from water-wet porous media by the use of surface-active agents.

2. In oil-wet systems, some benefits are possible, but the economics of a surface-active agent-injection process is uncertain.

3. For oil-wet systems, the reason for benefit by use of surface-active agents is that the oil left behind the water front is a continuous phase, in contrast to the discontinuous distribution in the water-wet system.

Atlantic defines a water-wet system as one in which the advancing water-contact angle (measured in the water) against oil is less than 90 degrees. An oil-wet system is one in which the advancing water-contact angle is greater than 90 degrees.

There is a direct influence of wettability of the rock surfaces upon the location of connate water in oil-wet and water-wet systems. The connate water in the water-wet case is in the pendular and tightest regions of the matrix, while in the oil-wet case water appears as globules in the funicular regions.

Water-wet systems . . . Drs. Moore and Blum reported that when a water-wet porous medium containing oil and connate water is water flooded, the injected water first displaces the connate water, which in turn displaces the oil. The oil left behind the water-flood front is in the form of discontinuous ganglia. These ganglia extend over several pore spaces, and since the oil is a nonwetting phase, they occupy the funicular region of the matrix.

The Atlantic investigators said, therefore: "It is obvious, considering the mobility of the connate water mentioned above, and adsorption, that no surface agents could be brought to the leading edge of a flooding front. Since this is true, no possible benefit in the recovery of oil at water breakthrough should be anticipated. Consequently, surface-active agents could be beneficial only if they aid in the displacement of the bypassed residual oil ganglia.

"To do this, the capillary force exerted by the water must be overcome or reduced to allow the oil to flow through the water-filled openings. This may be done by increasing the pressure gradient across the sample and by the addition of surface-active agents. To increase the pressure gradient across a reservoir much above present practice does not seem feasible. An alternative is to reduce the interfacial tension by the use of surface-active chemicals. It is estimated, however, that the interfacial tension must be less than 0.03 dynes per centimeter to permit flow of these discontinuous ganglia of oil when subjected to 1 psi. per foot pressure gradient. This also appears impractical."

Oil-wet systems . . . Atlantic's view for this phase was as follows:

"When water is injected into an oil-wet porous medium, the injected water proceeds through the funicular region, leaving extensive areas of oil as a continuous phase through the rock and in the smaller pores, in the pendular regions, and in a film on the matrix particles.

"In order for the oil to be displaced from such an oil-wet system, the water (nonwetting phase) must be made to penetrate the regions where oil is present. To do this, either the pressure gradient must be increased or the interfacial tension must be decreased.

"Therefore, on such premises either an increase in pressure gradient or decrease in interfacial tension will lead to a higher recovery of oil. This would be because the oil is present as a continuous phase in contrast with the discontinuous distribution of residual oil in the water wet case."

Penn State lab differs . . . Converse findings to that given in the Atlantic paper were put forth in the report "Experiments Using Surface Active Agents to Increase Oil Recovery," by R. A. Caro, J. C. Calhoun, Jr., and R. F. Nielsen of the Petroleum and Natural

Gas Engineering Department, Penn State College.

In experiments tagged "preliminary and tentative," run on small actual oil-sand cores, the Penn State group reported:

"It is apparent that wetting agents were more effective in lowering residual-oil saturations in the case of the Berea samples than in the case of the Allegheny and Bradford sand samples. Laboratory evidence indicates that Berea cores are preferentially water wet and Allegheny and Bradford cores are preferentially oil wet.

"If it is true that wetting agents are more effective in water-wet sands, then one might be inclined to say that a wetting agent to be used in Bradford field should preferably be one which would make the sand water wet, if such an agent can be found."

SOUTHWEST

Dehydration Economics

Relative merits of four basic methods of drying natural gas discussed by panel before natural-gasoline meeting

TYLER, Tex.—A panel discussion of economics and process factors of four basic systems of dehydration highlighted the southern regional meeting of the Natural Gasoline Association of America here October 24.

The four systems are glycol absorption, dry-desiccant, low-temperature separation, and glycol injection.

John Campbell, of Black, Sivalls & Bryson, Oklahoma City, said in his paper that from a practical standpoint the choice of methods usually narrows to a comparison of either the first two or the latter two methods.

When a pressure drop of sufficient magnitude is available so that either low-temperature separation or glycol injection may be employed, the selection will be based on economics, Campbell said.

Low-temperature separation, he said, permits increased recovery of condensate as well as production of a gas of a specified dryness. The amount of condensate recovery and drying is limited by the temperature of the low-temperature separator. This temperature, in turn, is limited by the hydrate formation temperature of the high-pressure gas and the available pressure drop.

The glycol-injection system, a relatively new development, has two advantages over low-temperature separation, Campbell added. Glycol not only inhibits hydrate formation prior to expansion, but gives positive dehydration in addition to that obtained by refrigeration.

The positive dew-point depression due to glycol injection is probably limited to about 40° F., which in turn limits the minimum amount of pressure drop needed to produce specification gas. Usually a minimum well-stream flowing pressure of 1,500 psig. will suffice, Campbell said.

Triethylene glycol now being used in most new absorption-type plants offers several key advantages over diethylene glycol, he said. Advantages cited were low initial cost, low operating cost, lower desiccant loss, and higher dew-point depression. Operating cost, he said, varied from 20 to 50 cents per M.M.c.f.

Activated alumina . . . Life of solid desiccants can be lengthened materially by reduction of the amount of contamination, proper reactivation, and avoiding mechanical damage, it was stated in a paper prepared by Boyd F. Koepke and Dr. V. M. Stowe, of Aluminum Research Laboratories, East St. Louis.

Contaminants present a serious problem, he said. Heavy fractions, when absorbed, are not removed during reactivation because of their high end points; an accumulation then builds up which takes up the surface area on the desiccant which should be available for water adsorption, the authors said.

Proper reactivation is insured by heating the entire desiccant bed to at least the minimum temperature recommended by the desiccant manufacturer. If the temperature is too low, heavy fractions and water are not removed, thus reducing the capacity.

Mechanical damage to desiccant beds can be prevented, the authors declared, by holding gas throughput to rated capacity. Exceeding the rated capacity may result in blowing a deep crater in the top of the bed and in pulverizing the desiccant; if the flow is upward, the entire bed may be lifted and abraded.

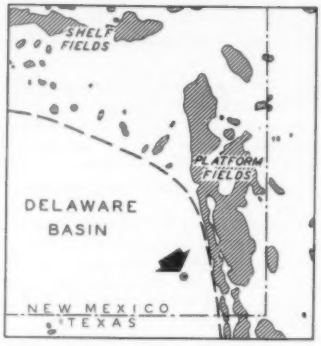
Precooling the gas before dehydration is advantageous, they noted, since desiccants exhibit higher dehydration capacity as the temperature is lowered. Too, cooling of gases containing heavy oils or distillate coalesce the oil in the vapor phase to liquid droplets, after which it may be trapped out in an accumulator tank. It also decreases the moisture content of the gas.

Delaware Strike

Discovery indicated in deep test of rank wildcat area

HOBBS, N. M.—A potentially significant oil strike in the all-but-productionless Delaware basin has been made by Sun Oil Co. and General

DEHYDRATION PANEL speakers at the N.G.A.A. southern regional meeting at Tyler, Tex., included, left to right, W. S. McAllister, Warren Petroleum Corp., Gladewater, Tex., moderator; E. Paul Wilkinson, Magnolia Petroleum Co., Dallas; Clarence O. Glasgow, National Tank Co., Tulsa; Boyd F. Koepke, Aluminum Co. of America, Kansas City; and John Campbell, Black, Sivalls & Bryson, Oklahoma City. Economics of the basic dehydration methods and process factors involved were given principal attention by the panel.



LOCATION of the new basin strike.

American Oil Co. of Texas in Lea County, just to the west of the Central basin platform fields.

The wildcat, 1 Harper-Federal, 26-25s-35e, originally drilled by General American to 6,054 ft., was reentered on a 13,500-ft. contract. A drill-stem test of the Bone Springs limestone, a Permian formation lying beneath the Delaware Mountain group, brought gas at the top in 1 hour and 16 minutes.

Pipe recovery was 2,500 ft. of heavily oil and gas-cut water blanket plus 3,600 ft. of 40°-gravity oil. Test was at 11,665-88 ft.

A flow test of perforations at 11,662-69 ft. produced 225 bbl. of oil and 19 bbl. of drilling mud in 17½ hours through chokes ranging from ¾ to 28/64-in. Tubing pressure ranged from 700 to 150 psi.

A later test through perforations at 11,661-89 ft., flowed naturally at a rate of 10-15 bbl. of oil per hour before it began making mud and died. Following treatment with mud acid, the well swabbed and flowed 133 bbl. of oil in 9 hours; it then gaged 59 bbl. of oil in 11 hours and died. Operators believe the hole and testing tools were clogged with mud.

Proration Dilemma

Texas and New Mexico agencies huddle with operators to negotiate uniform rules for two-state Dollarhide field

MIDLAND. — Regulatory bodies of Texas and New Mexico were wrestling last week with a knotty oil and gas-proration problem—what to do about a field that straddles the state line.

Dollarhide field, a multipay area, is produced in both states and currently is subject to two sets of regulations concerning location of wells and production rates. In New Mexico, Dollarhide wells in southeastern Lea County produce all days of the month, while in southwestern Andrews County, Texas, production is subject to shutdown days.

As a result, it is possible for wells directly offsetting each other across the state line to be producing at widely differing rates. To arrive at an equitable compromise a hearing was held here before representatives of both the Texas Railroad Commission and the New Mexico Oil and Gas Conservation Commission October 23.

Continuous horizons . . . Engineering testimony before the joint meeting showed that in the general area four different horizons are producing—Clearfork or Drinkard, Devonian, Silurian, and Ellenburger.

Only the first two of these were shown to be continuous across the state line from a productive standpoint, but testimony indicated that behavior in the Silurian and the Ellenburger might be influenced by disproportionate withdrawals from a field in the same horizon across the state line—even though the productive areas are not continuous.

Operators were virtually unanimous in saying that regulations across the state line should be the same—particularly with regard to acreage allowed to wells, the allowable per well, and the proration formula. Most operators appeared to favor 40-acre proration units with production based 100 per cent on acreage. It was on the subject of basic allowable that disagreement came.

Allowable disagreement . . . Currently the field is producing 30,380 bbl. per day from the Texas portion of the reservoirs in four pays from 327 separate completions. New Mexico lags considerably in completions with 19.

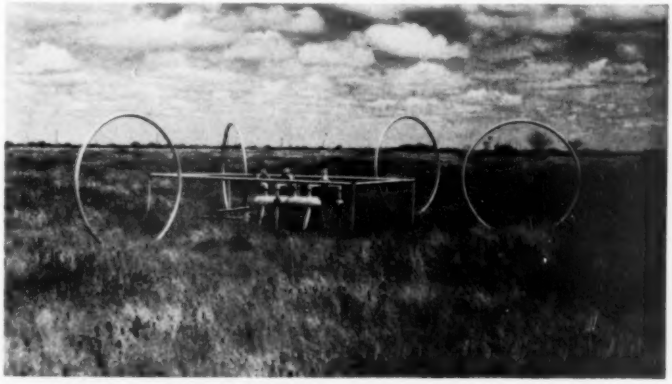
Texas production per well is determined by a 75 per cent acreage—25 per cent well formula using a basic allowable of 92 bbl. per day for the Clearfork, and 100 bbl. per day for the Devonian, subject to shutdown days.

New Mexico wells are producing 80 bbl. per day from the Clearfork, and 135 bbl. per day from the Devonian without shutdown days.

Since these are the two formations that are continuously productive across the state line, they are the ones with which operators and the commissions are most concerned.

The plan favored by operators would be to make the allowable in both the Clearfork and Devonian formations in both states equal to the Texas MER, 92 and 100 bbl. respectively, and permit them to produce every day of the month. This would result in a penalty in New Mexico production, and cause Texas Dollarhide production to continue throughout the month.

The two state commissions so far have been unable to reach a compromise—which would involve departing substantially from traditional methods in regulation in each state.



Strictly Business in the Field

These aren't leftovers from some game, but an important part of Plymouth Oil Co.'s gathering system in Sinton field of San Patricio County, Texas. The expansion loops are in four high-pressure gas lines running to a multiple knockout drum, in the center of the picture, which recovers liquids accumulating in the line before the gas is sent to a nearby gasoline plant.

Resources Plentiful

Shortage of oil has been feared ever since it was found, Cram tells geologists, but technology keeps postponing it

LOS ANGELES.—The oil industry is not running out of either resources or resourcefulness and faces the future with confidence in its ability to get the job done if allowed to do it, in the opinion of Ira H. Cram, vice president in charge of exploration, Continental Oil Co., Houston.

Addressing the annual meeting of the Pacific Coast section of the American Association of Petroleum Geologists, Cram said the evidence that we are not running out of resources is crystal clear to him. He pointed out how the undiscovered reserve has responded to the industry's effort to reduce it to the proved reserve every time the industry put on a sustained drive.

During the last period, 1944-51, 60 per cent more oil and 20 per cent more gas were found per year than during the so-called "good old days" of 1925-30, he said, and 20 per cent more oil and 120 per cent more gas were found per well drilled.

Cram asked, "If each successive period of sustained effort brings forth larger quantities of reserves per unit of total effort, how can there be any valid argument against the conclusion that the end of sizable discovery is not in sight?" He said that the resource is still responding beautifully to the effort and the day that it will not respond to the industry's effort has been "just around the corner" for longer than most men can remember.

Cram said an increasing number of geologists look with favor upon areas previously mentally condemned, a development which, together with technological advances, have yielded expanded horizontal and vertical hunting grounds.

Resourcefulness . . . The list of exploratory tools which have emerged during the past decade is not impressive when compared to the effectiveness of the reflection seismograph invented during the 1930's Cram said.

It has been the advance of technology on a broad front in the form of a few new gadgets plus improvement in all methods and instruments, the use of them, and the interpretation of results that have enabled the industry to keep oil finding rates high. He said that the technological advances permeated every branch of the industry and because of the interrelation and crosstertilization of technologies, exploration technology was further improved by the advancing technologies in other fields.

Cram concluded that advancing technology during the past decade furnished the explorer with the equivalent of a brand new tool; not a dramatic one, but an effective one.

Price-Hike Outlook Good

WASHINGTON. — California producers are seen here as having a "better than even" chance of getting an increase in the price ceilings on their crude oil.

Price officials have indicated a belief in the merit of the arguments raised by the California industry in its applications for relief, on which the Petroleum Administration for Defense has been asked to make a report. Last month the Office of Price Stabilization asked PAD for its views on the application of Standard Oil Co. of California for revision of ceilings on all crude, natural gasoline, and products, and followed it up with a similar request on the application of the Union Oil Co.

The PAD report will not concern itself directly with the question of prices but will be in the form of an analysis of the present and future supply situation in the state. Previously PAD submitted a report on California heavy crude, taking the position that raising the ceilings on that type alone would not be an adequate solution.

Kettleman Unit Ready

LOS ANGELES.—Full unitization of the Kettleman Hills North Dome field, with Standard Oil Co. of California as operator, will become a reality if an agreement reached by the field's operators is approved by the Secretary of Interior.

The field, containing 330 active wells producing about 22,000 bbl. of oil daily, has been partially unitized since 1931. During this period Standard produced its wells in odd-numbered sections and Kettleman North Dome Association operated the properties of member companies in the unitized even-numbered sections. As a majority of the K.N.D.A. operated lands are federally owned, Interior's approval is required of the plans.

In announcing the agreement, Standard stated that unitization will permit more efficient over-all operation and will result in maximum oil recovery.

All pools in the field are to be operated as a unit but the Temblor zone, which extends over some 16,000 acres, is the field's major pay. Of the 390 million bbl. produced to date, over 350 million has been from this zone.

Oil-Rights Issue Settled

LONG BEACH. — California and Long Beach city officials at a meeting here October 24 agreed to compromise their differences over oil rights in 850 acres of submerged lands lying offshore of Alamitos Bay State Park.

Under a plan yet to be worked out, development of the oil reserves believed there will be handled mutually by the state and city. Any income which may be realized will be divided between the two.

Long Beach in 1932 quit-claimed a portion of the Alamitos peninsula in favor of the state, with the reservation that the land must be used for recreational purposes. Since then a difference of opinion between city and state bodies has arisen as to ownership of mineral rights under the strip of beach and the offshore extension to the 3-mile limit. Claims of both groups, however, must await action of the Supreme Court as the area is beyond the stipulated line.

New Plant Mothballed

BAKERSFIELD.—California's newest gas-processing plant—the 50,000 M.c.f. natural-gasoline and pressure-maintenance plant at Elk Hills—has been completed.

Instead of being placed onstream, however, the plant is being mothballed against the time a national emergency requires its use.

Designed by Standard Oil Co. of California, operator for the Elk Hills Naval Reserve, the plant was scheduled to undergo a 30-day test upon completion. Because of the difficulty of opening up the huge shut-in field, which would require Congressional action, no test of processing facilities will be made at this time.

While the $4,500,000 plant has a 50,000 M.c.f. daily capacity, equipment for a 100,000 M.c.f. plant was installed where feasible. Construction of the plant was performed by Parsons-Macco Co., Los Angeles.

Northern Natural's Growing Pains . . .

. . . typify gas industry's problems in expanding to meet fast-growing demand

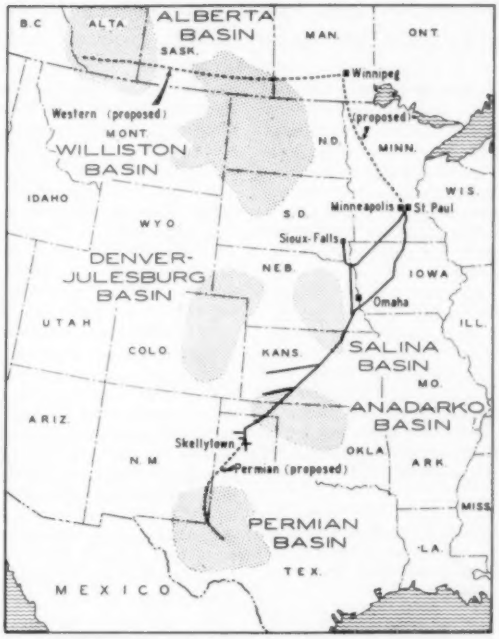
Henry D. Ralph

OMAHA.—Just about all the problems of the natural-gas industry are wrapped up in the present troubles of Northern Natural Gas Co., thus making that company a good case study of what other transmission lines face now or will be up against soon.

An insistent clamor of consumers for more gas has sent company geologists and land men to half a dozen possible gas-producing areas to find new reserves, and has necessitated a breath-taking schedule of construction to enlarge its trunk lines.

At the same time, the Federal Power Commission seems to have made Northern Natural a guinea pig for experiments with new regulatory ideas and rate-making policies. These FPC actions have slowed down expansion operations and threaten to deprive the company of sufficient funds to carry out its plans.

Northern's 5,500-mile system extends from the Texas Panhandle northeast through its Omaha headquarters to Sioux Falls, S. D., and Minneapolis and St. Paul, Minn., an air-line spread of some 800 miles, through which it delivers natural gas to 230 communities in Kansas, Nebraska, Iowa, South Dakota, and Minnesota.



Northern's system and where it is looking for gas.

Expanded fast . . . In 1932, just 2 years after Northern's incorporation, its system had a capacity of 100 million cubic feet per day. By 1945 it was 265 million, by 1947 it was 390 million, by 1949 it was 470 million, and by 1950 it was 600 million.

This almost geometric growth shows no signs of slackening. All of Northern's local utility distributors have switched from mixed gas to 100 per cent natural gas, and this has accentuated the trend toward use of gas for home heating. Northern figures that its potential house-heating market in communities now served is only about 50 per cent saturated. At present around 100,000 owners of homes already connected to mains in the 230 communities have requests on file for gas heating but are unable to hook up their furnaces because of insufficient supply.

The presently connected 230 towns have unsatisfied requests for 150 million cubic feet of gas per day during 1952, and have filed requests for a like amount of additional gas for next year, making a total of 300 million additional willing to contract by 1953.

Demand growing . . . These same connected communities expect to ask for an additional 100 million feet in 1954, and to increase their demands by 75 million each in 1955 and '56, and by 50 million each in 1957 and '58, or a total increase of 650 million in 6 years. Northern's present capacity is 675 million cubic feet per day, so it must double its capacity by 1958 just to serve present customers.

Throughout the general area Northern now serves, and not too far from its present trunk lines, are many other communities not served by natural gas but which want such service. Estimating the markets in such of these communities as it could serve economically and with a practical schedule of new construction, Northern figures that its increased demand from such markets would be 175 million cubic feet per day by 1955 and reach 250 million in 1956, 310 million in 1957, and 375 million in 1958.

Big job ahead . . . If these new markets can be served in addition to present ones, Northern will need capacity for around 1,750 million cubic feet per day by 1958. This means increasing its present capacity by between two-and-a-half and three times within the next 6 years.

In terms of annual deliveries, this schedule calls for Northern to sell half a trillion cubic feet of gas in 1958. Sales of this magnitude would require it to have proven reserves of gas in the ground of 12 or 13 trillion cubic feet.

Northern's present reserves are about 6 trillion cubic feet. This is why the company is actively trying to discover or purchase gas reserves in every likely spot from New Mexico to Canada.

Trouble with reserves . . . A construction program to keep pace with this growth in demand has been outlined

(Continued on page 172)

No Imports Needed?

I.P.A.A. report says nation can produce all the oil it needs by 1955, but imports - session speakers don't agree

Henry D. Ralph

OKLAHOMA CITY. — The United States can produce enough crude oil to meet all domestic demand without reliance on imports by 1955, but domestic producers cannot build up a reserve producing capacity without an adequate price to support it nor under the threat of heavy imports.

This was the conclusion of the Independent Petroleum Association of America as expressed in resolution and committee reports submitted at its annual meeting here October 23-24.

The backbone of the conclusion was a monumental, 50,000-word report of the association's committee on petroleum in the Western Hemisphere, 18 months in preparation.

Conclusions . . . The United States can have the capacity to produce 9,600,000 bbl. daily by 1955 and 12,000,000 bbl. daily by 1960 if projected trends are fulfilled, the report stated.

Domestic and export demands were projected at 8,682,000 bbl. daily in 1955.

These projections would indicate that the United States could meet all demands from its own production and still have a reserve capacity of 918,000 bbl. per day within maximum efficient rates of production.

If imports remain at the postwar ratio to domestic demand or at the 1950 rate of 850,000 bbl. per day, domestic production in 1955 will be 7,832,000 bbl. daily.

However, if imports increase according to trends projected by the committee, they will reach 1,580,000 bbl. daily and domestic production will be only 7,102,000 bbl. daily.

Throughout the report the committee reiterated that its statements about the future are not programs or recommendations but are simply statistical projections of trends and assumptions as explained in the report.

Imports threat . . . The greatest threat of petroleum imports is not the Middle East but from producing countries of the Western Hemisphere south of the United States, the committee concluded.

Its projection of trends of increased producing capacity indicate that by 1955 this region will have 1,320,000 bbl. daily to export to the United States after satisfying all other markets. This compares with 1950 imports of 734,000 bbl. daily into the United States from countries to the south.

The Eastern Hemisphere, the committee concluded, will be largely self-sufficient and by 1955 will be exporting 260,000 bbl. per day to the United States, an amount which could easily be absorbed by East Coast refineries. Imports from the Eastern Hemisphere in 1950 were 116,000 bbl. daily.

The committee called on the industry and government agencies to use the studies in its report as tools for formulating future policies affecting oil production in the United States. The projections are not precise measurements, it said, but within broad limits they are indicators to be used in forecasting the amount of steel and money required by the industry, its producing rates and return from the sale of its oil, and national policies on imports and reserve producing capacities.

Domestic supply adequate . . . The most important single conclusion of the report, said President Charlton Lyons in presenting the document to the convention, is that the United States oil industry has the ability to meet all requirements if it has the proper political and economic climate.

This means, he added, that the market must be protected against excessive imports and that the price of oil must be sufficient to give the industry the funds to continue to build up producing capacity.

The Western Hemisphere report was presented at a session devoted to the place for oil imports, with speeches by spokesmen for the State Department, major oil importers, and independent producers.

State Department view . . . For the State Department, Robert H. S. Eakens, chief of the petroleum policy staff, defended the administration's import policy, particularly the recent trade agreement with Venezuela which reduced import duties.

Looking ahead to 1975, he quoted the recent Paley report as indicating we will then need to import 2,500,000 bbl. of oil per day while domestic production will be 11,200,000 bbl. daily, implying that the present trend of imports is not out of line with this projection.

It is important to the free world to build up producing capacity in other countries, he said, and Venezuelan imports are essential because they are largely heavy crude and fuel oil which are short on our East Coast.

Without government controls, imports are finding their proper place alongside a healthy domestic industry, Eakens said, and he advised against attempting to define the place of imports in terms of specific quantities.

Importer's view . . . Speaking for an importing company, John Suman, vice president of Standard Oil Co. (N. J.), saw no reason to believe that imports are not maintaining their proper place as supplementing domestic production.

Excluding the West Coast, Suman said imports were 10.8 per cent of production in 1950, a normal year. In 1951 the ratio started out a little below this and then the Iranian shutdown brought the ratio to 7.5 and averaged it off as 9.3 per cent for the entire year. So far this year the ratio is 10.4 per cent.

California has had a shortage of crude and has increased its imports, thus showing, Suman said, that flexibility in imports is necessary in order for foreign oil to supplement domestic production when needed. He also stressed the fact that much of the oil imported to the East Coast was heavy crude and residual fuel which is short there, being another example of supplementation.

"In the 3 years since the National Petroleum Council's policy on imports was expressed," said Suman, there has not been a variation of more than 1 per cent in the annual ratio of imports to domestic crude production. In spite of the transient peaks and valleys, the volume of imports has maintained a constant ratio to domestic crude production.

"What all this proves, I think, is that the implementation of our import policy has truly been both flexible and realistic. In times of spot shortages here, imports have been available so that customers did not have to suffer. Conversely, during times of foreign shortages, such as when Iran shut down, through decreases in imports the United States industry has been able to alleviate the pinch of reduced supplies elsewhere.

"To my way of thinking, as imports have played their consistent role in helping the domestic industry solve so

MASTON NIXON—attacks "fudging."

many different problems here and abroad they have thereby contributed to the health and wellbeing of the free world."

The government request that the industry build up a reserve producing capacity of 1,000,000 bbl. per day need not and should not be used as the gage in determining whether we are importing too much or too little oil, Suman declared.

Independent's view . . . A far less philosophic and complacent view was expressed by Maston Nixon, president of Southern Minerals Corp. and chairman of the I.P.A.A. import policy committee.

Recent imports, he said, are not far out of line with historic ratios after exclusion of emergency imports into California. Most companies are holding their imports in line with the policy of the National Petroleum Council but a few, particularly those without foreign production of their own, have "fudged" some recently, he declared, and they "should lay their import figures alongside their conscience."

The big threat lies in the near future, he said, because of the prospects of increased production in Latin America, the fact that Middle East countries are already producing more oil without Iran than before the Iranian shutdown, and the possibility that Iranian oil will come back on the world market.

Without worrying about 1975, Nixon asked "How about 1955?" and answered it:

"The Western Hemisphere committee reports that if projection of past trends is followed in forecasting demand, domestic production, and imports in 1955, then imports would be at a level of 1,580,000 bbl. per day while shut-in capacity in the United States would be 2,500,000 bbl. per day. "Can the United States producer stand the carrying of that much capacity that is not producing income? I say no."

Throwing away his prepared text, Nixon shouted:

"The plight of the domestic producer is terrible in the light of the need for increased producing capacity. He is willing and could be able to provide the reserve capacity requested by the PAD but is prevented by other agencies of the government.

"Imports were increased while allowable production in Texas was being curtailed. The Venezuelan trade agreement resulted in increasing the posted price of crude in Venezuela while the OPS denied a price increase in the United States.

"If we build up the requested producing capacity and if imports continue to increase as projected, within 3 years we may have 2,500,000 bbl. per day shut-in capacity in this country, which means 27 per cent of our investment nonproductive. The Government is asking us to build up capacity but denies us any income from our investment.

"If national defense requires reserve capacity in this hemisphere, then other countries must bear their share of carrying the excess, and Venezuela must cut back to the same extent as Texas." Canada probably will keep production in line with reasonable market demand and will carry a large reserve producing capacity, Nixon said. He added that the I.P.A.A. should adopt a different policy toward Canadian oil than toward other imports and that Canadian oil should be permitted to come into the United States, particularly to the West Coast, without duty so long as the quantity does not exceed the volume of United States oil purchased by eastern Canada.

Resolutions . . . On Nixon's motion the convention adopted a resolution expressing grave fears of the threat of excessive imports and declaring that "the great and growing threat of excessive imports demand a governmental and industry attitude which will assure a proper place for imports under the sound and accepted petroleum policy."

On prices, the association adopted a resolution denouncing the Office of Price Stabilization for imposing rigid ceilings on oil and gas and called on it to cooperate with other defense agencies in making it possible for the industry to carry out the expansion program requested by the Petroleum Administration for Defense.

A third resolution asked PAD to determine the physical and economic conditions, including necessary price levels, essential for the attainment of the expansion goal set by that agency.

Officers elected . . . Charlton H. Lyons, Shreveport producer, was reelected president of the I.P.A.A., along with all other principal officers. New vice presidents elected were:

John E. Howell, vice president, Lion Oil Co., El Dorado, Ark.; Joseph M. Thomas, Joseph McDonald Oil Co., Bakersfield, Calif.; Ira Van Tuyl, partner and manager, V-T Drilling Co., Evansville, Ind.; Thomas A. Jirik, president, Cedar Creek Oil & Gas Co., Fairbault, Minn.; John M. Lovejoy, president, Seaboard Oil Co., New York; W. M. Shoemaker, engineer, Forest Oil Corp., Bradford, Pa.; W. J. Weaver, trustee, Owenwood Pool No. 3, Fort Worth; B. L. Woolley, independent producer, Dallas; William D. Noel, president, Trebol Oil Co., Odessa, Tex.; and Harold Decker, president, Houston Oil Co., Houston.

New executive committee members are: Creston Alexander, vice president, Creslenn Oil Co., Dallas; F. Allen Calvert, Jr., president, Calvert Drilling, Inc., Olney, Ill.; Paul Barnhart, independent producer, Houston; M. R. McArthur, vice president, Husky Oil Co., Cody, Wyo., and Alden S. Donnelly, vice president, Honolulu Oil Corp., Midland, Tex.

Certificate Issued

U. S. Pipeline gets fast tax writeoff on project

NEW YORK. — United States Pipe Line Co. has received a certificate of convenience and necessity from the Defense Production Administration permitting accelerated amortization over a 5-year period.

This amounts to 25 per cent on the pipe-line facilities for the proposed Beaumont, Tex.-Newark, N. J., products line and 40 per cent on terminal tankage. Right of eminent domain is said to be also granted by the certificate.

Plans for the United States Pipe Line

Co. project have been expanded from the earlier $65,000,000 program to one of larger capacity estimated to cost $140,000,000.

Capacity . . . The proposed daily average throughput is approximately 250,000 bbl. of refined products. Of this amount, 50,000 bbl. would be for spot shipments. The remaining 200,000 bbl. capacity would be available for shippers which would arrange for transportation on the so-called "shipper-pay-contract" basis. These shipper-pay contracts would assure regular income over a period of years for this project planned for no-shipper ownership.

Routing . . . The entire project from Beaumont, Tex., to Newark, N. J., would have a total of 1,676 miles, including 1,456 miles of trunkline and 220 miles of laterals.

From Beaumont a 476-mile section of 26-in. pipe would extend through Port Neches, Tex., Shreveport, El Dorado, Ark., Pine Bluff, Ark., and Helena, Ark., to Memphis.

A 311-mile, 24-in. section is planned from Memphis via Paris, Tenn.; Nashville, Tenn., to Louisville, Ky.

The remainder of the trunkline east of Louisville would be 669 miles of 22-in. extending through Cincinnati, Pittsburgh, and Harrisburg, Pa., to Newark, N. J. Two lateral lines would run from the trunkline to Paducah, Ky., and Lexington, Ky.

NEW A.G.A. PRESIDENT is Frank C. Smith, president of Houston Natural Gas Co., Houston, second from left. Smith was elected to serve during the 1952-53 year at the organization's thirty-fourth annual convention last week. In this group are: J. J. Quinn, vice president, Boston Consolidated Gas Co.; Smith; Herbert P. Stillwagen, executive vice president, Indemnity Insurance Co. of North America, Philadelphia, one of the convention speakers; and Dean H. Mitchell, president, Northern Indiana Public Service Co., Hammond, Ind.

Warning Issued

Gas-utility industry must get out and push its product, promote research, win public's confidence, A.G.A. hears

Dahl M. Duff

ATLANTIC CITY. — The gas-utility industry was warned at the thirty-fourth annual convention of the American Gas Association here last week that it cannot rest on its laurels but must actively merchandise its product, promote research, and win public confidence in the safety of its operations.

The retiring A. G. A. president, Charles E. Bennett, president of Manufacturers Light & Heat Co., told the meeting it is now recognized that natural gas—its production, transmission, and distribution—has become synonymous with the nation's gas industry, and that its phenomenal expansion since the end of the war has multiplied the industry's problems.

Even greater regulation of business and industry is currently being advocated, he said. The industry's ability to raise the capital necessary to render the service demanded by the public is being endangered by a new theory of rate return and other disturbing precepts now being advanced.

Bennett strongly recommended that the industry's research activities be expanded and that the lag in utilizing results of research be reduced. The present A.G.A. research program, costing $700,000 or only one-fifth of one per cent of the gas industry's net revenue for 1951, should be materially enlarged, he said.

In the matter of public safety, Bennett bluntly told the convention that the gas utility industry has not done as good a job, as for example, have the railroads. Public opinion on this point, he added, poses a problem which cannot be ignored, and the industry must restore public confidence in the safety of its product, pipe lines, compressor stations, appliances, and related equipment.

Frank C. Smith, president, Houston Natural Gas Corp. and the new president of the association, dwelt in detail on what he termed the industry's "problem of problems" — the inroads being made by electricity on the prime gas utility market in household cooking, water heating, and refrigeration. He cited figures showing that in 1941 the ratio of gas to electric ranges manufactured was 3-to-1 but that last year it had dropped to 1.7-to-1.

Officers and awards . . . The convention drew a record attendance of approximately 8,000 representatives of gas companies, appliance manufacturers, and dealers. The papers presented in the general and sectional meetings ranged over the entire field of subjects of interest to the industry. The operating section of the association held three meetings and heard committee reports and several discussions on synthetic fuels and gas production, corrosion, and odorization of gas.

Besides Smith as the new president, other officers elected for the 1952-53 association year included, first vice president, Earl H. Eacker, president of Boston Consolidated Gas Co., and second vice president, F. M. Banks, president and general manager of Southern California Gas Co. Among the gas executives named A.G.A. directors were Paul Kayser, president, El Paso Natural Gas Co., Robert A. Hornby, executive vice president, Pacific Lighting Corp.; and William T. Stevenson, president, Western Kentucky Gas Co.

Channing W. Wilson, research chemist, Consolidated Gas Electric Light & Power Co., was named chairman of the operating section, and Frederick J. Pfluke, superintendent of gas operations, Rochester Gas & Electric Corp., section vice chairman. Among the awards presented at the convention was one for the outstanding distribution achievement, to Frank J. Hall, superintendent of distribution plant, Michigan Consolidated Gas Co., for his work in the development of lightweight service trenchers.

Everett L. McDougal, construction foreman for Pacific Lighting Gas Supply Co., was awarded the A.G.A. Meritorious Service Medal for bravery in recognition of his rescue last June 25 of a fellow worker from a burning gas line in an excavation where a drip was being installed.

Producers represented . . . E. I. Thompson, executive vice president of the Texas Independent Producers and Royalty Owners Association, told a joint session of the Natural and Manufactured-Gas Departments that the country's gas consumers had deliberately "cut their own throats" by contributing to the agitation which resulted in the veto of the Kerr bill which would have definitely divorced gas production from

Federal Power Commission regulation.

Many producers still refuse to sell their gas out of state because of the fear of federal regulation. "I have no doubt," he said, "but that public officials of the consuming states who consistently devote so much of their time to efforts at field price regulation will some day realize how shortsighted they have been, for the time will come when consumers will realize that their goal should be maximum supply, rather than minimum price."

Thompson struck hard at the propaganda he said comes out of Washington in favor of continued regulation. It should be obvious, he said, that the well-head price is but a fraction of the final delivered price of gas which, in one state which most vigorously urged regulation of field prices, is about $1.56 per M.c.f.

As an example showing that adequate returns to the producer are vital to continued exploration, Thompson cited a new gas discovery in a large geologic basin adjoining the Texas Panhandle. Exploration is lagging in this new area since the wells are deep and expensive and the average price of gas in the Panhandle fields is only about 6 cents.

Thompson called the gas price situation in Texas "chaotic," in that prices range from 2 to 15 cents with the low prices provided in many contracts entered into years ago and which run for the life of the lease. In the Hugoton field which lies partly in Kansas and Oklahoma and extends over into the Texas Panhandle, state laws require the payment of a minimum well-head price of 8 cents in Kansas and 9.8 cents in Oklahoma. "A Texas producer with property adjoining the Oklahoma state line sits there helplessly watching his gas go for 3 cents while right across the line and from the same reservoir, his Oklahoma neighbor is getting almost 10 cents for the same gas," Thompson said. "On top of that the same pipe-line company may be serving both properties and taking more of his 3-cent gas than from his Oklahoma offset at 10 cents."

Several minimum price bills have been prepared for the next Texas legislature, he said. The producers do not want this but such a law may be inevitable unless some other solution to the dilemma is found. He mentioned that there are many conservation officials who still feel that the export of gas from the producing states should be limited for the ultimate benefit of the producing states.

Gas Research Needed

Studies should continue on coal gasification, synthesis, although natural-gas reserves seem adequate, A.G.A. told

ATLANTIC CITY.—Although present natural-gas reserves indicate a supply for many years to come, the gas industry should maintain continuing studies of developments in the field of coal gasification and gas synthesis against the time when economic supplies of natural gas are no longer available.

This is the belief of Charles F. De Mey, Columbia Gas Service System Corp., who expressed his views before the operating section of the American Gas Association here.

De Mey visualized, on the basis of present knowledge, a plant producing 100 billion B.t.u.'s which would require something more than 6,500 tons of coal daily. Water requirements would be about 15,000,000 gal. daily, and the output or generating capacity for synthesis gas, approximately 400,000,000 cu. ft. daily.

If coal were delivered at the plant at $4 a ton, he said, the current cost of the final "substitute" gas, obtained by catalytically reacting the synthesis gas, has been variously estimated at between 55 and 65 cents per M.c.f., delivered to the pipe line. The cost of process fuels is between 27 and 32 cents of the total, or about 50 per cent. For each $1 change in the cost of coal, the cost of gas would change about 6 cents.

The process used in the recently publicized coal hydrogenation operations by the Bureau of Mines and Union Carbide Co. so far have no place in the search for a substitute gas, De Mey said. The hydrogenation process is much more costly per unit of product than gasification and while it produces hydrocarbons, they belong to a different group not particularly suited for producing gas but very valuable in the chemical industry.

Underground storage . . . At the beginning of this year, underground gas-storage projects in the United States had an ultimate reservoir capacity of 915,988,520 M.c.f. as compared to 774,433,966 M.c.f. a year earlier.

The projects involved 32 companies and 142 pools in 15 states as of the beginning of this year, according to the first annual report of the A.G.A.'s committee on underground storage which was presented at the convention.

The report showed the underground storage projects involved 96 compressor stations with a total of 211,480 hp. Gas in storage as of December 31, 1951, was 474,411,000 M.c.f.; input to storage for the year ending October 31, 1951, was 337,744,845 M.c.f.; and output from storage during the same period was 200,434,703 M.c.f. Maximum daily output during this 12-month period was 3,240,626 M.c.f. The largest number of pools of any state was in Pennsylvania with 51, with a total ultimate reservoir capacity of 178,644,029 M.c.f.

Gas and petrochemistry . . . The current interest of oil and natural-gas transmission companies in the manufacture of ethylene arises out of the bright outlook for this chemical and a tremendously increasing demand which is expected to require an increase in production from about 1½ billion pounds annually at present to some 4 billion pounds within the next few years, G. R. Walton, industrial engineer, United Gas Pipe Line Co., Houston, said at a meeting of the Industrial and Commercial Gas Section.

The cost of an ethylene plant is considerable but many companies are studying the possibilities of such an operation as pioneered by the Tennessee-Mathieson and Panhandle-National Distillers combinations. As constituents of gas at the field, ethane and propane are worth about a quarter of a cent a pound, but by extracting this cut and cracking to olefins or unsaturates, the price jumps to 4-5 cents a pound.

Polyethylene production is the most rapid growing business of the entire chemical parade, Walton said. During the last 18 months, more than $150,000,000 in polyethylene plants on the Gulf Coast alone have been announced, and the present production is expected to rise to around 500 million pounds annually in the next few years.

As one of the many products from ethylene, polyethylene is finding wide use as plastic sheeting for lining cardboard drums and boxes to replace scarce steel and tin. Use of polythene pipe is rapidly growing in the oil and gas fields, Walton said, particularly for service lines in California.

In his review of petrochemical developments, Walton pointed out that prior to 1940 there were practically no chemical plants in the South. From 1940 to 1950, more than 1½ billion dollars were spent on chemical plants divided about as follows: heavy chemicals, $140 billion; synthetic rubber, $480 million; plastics and fibers, $250 million; solvents (alcohols, etc.), $413

million; and miscellaneous, $215 million.

Walton said that the overwhelming majority of the gas used in this industry, now and in the foreseeable future, is as fuel. Even in the petrochemical plants themselves, the majority of gas is for heat and power. Very little gas makes a great deal of petrochemicals, a point Walton illustrated by saying the gas used each month by the average residence in Washington, D. C., would make about 260 gal. of paint remover or 60 gal. of antifreeze.

The percentage of natural gas used for chemical purposes will remain at about 7 per cent through 1955, and, with increased gas output, will amount to about 4.3 per cent in 1975, Dr. Gustav Egloff, Universal Oil Products Co., said in a talk at a general session. These percentages, however, will represent about 40 per cent of the total petrochemical production.

Exhibits Chairman

Westby accepts as head of I.P.E. selection committee

TULSA.—G. H. Westby, president of Seismograph Service Corp., has accepted appointment as chairman of the International Petroleum Exposition's Scientific and Technical Committee.

The committee will be charged with selecting exhibits for the Hall of Science at the big oil show here May 14-23, 1953.

In announcing Westby's acceptance, W. G. Skelly, I.P.E. president, said the committee will be assisted by screening subcommittees which will select the better exhibits from drilling, production, transportation, refining, natural gasoline, and other industry divisions.

Shown examining layout of the Hall of Science in the photograph are (left to right) Kent Kimball, consulting geologist and executive secretary of the Scientific and Technical Committee; B. B. Weatherby, vice president of Amerada Petroleum Corp., chairman of the committee for the 1948 exposition and consultant for the 1953 committee; William B. Way, general manager of the exposition; Westby; and A. L. Solliday, executive vice president of Stanolind Oil & Gas Co. and consultant to the committee. Not shown is Dr. Gustav Egloff, Universal Oil Products Co., former chairman of the committee and a consultant to it this year.

Industry Briefs

CALGARY, Alta.—Britalta Petroleums, Ltd., has farmed out 1,060,000 acres in Saskatchewan to Duck Lake Syndicate, an eastern Canadian group, for $1,000,000. The syndicate, headed by Lt. Col. E. Gerald Hanson, Montreal, will conduct a 2-year exploration and development program on the acreage.

WICHITA.—Kansas' all-time-high crude-production allowable has been continued for the third straight month at 330,000 bbl. daily. The state corporation commission last week approved the recommendation of T. A. Morgan, conservation director, to retain the record allowable. Purchase nominations for the month totaled 338,758 bbl. daily, Morgan said. This was up 373 bbl. daily over October offers.

CALGARY, Alta. — Marigold Oils, Ltd., and associates have acquired a farmout on 12 sections in the Carmangay area of Alberta from Seaboard Oil Co. of Delaware. Marigold, Somerset Oils, Ltd., and Paige Petroleums, Ltd., plan a wildcat on the acreage to test the Madison lime at about 5,000 ft. The group will get 50 per cent of any production on the acreage in return for drilling expenses.

BATON ROUGE. — The Louisiana Conservation Commission has set the November crude-oil allowable for the state at 685,027 bbl. daily—up 3,081 bbl. from last month. This is the third consecutive monthly increase. South Louisiana production was set at 566,750 bbl. daily, the remainder going to fields in the north.

BATON ROUGE.—Bids for mineral leases on 34 tracts of state lands totaling about 70,000 acres will be opened here by the Louisiana mineral board November 20. More than 60,000 acres are under or near Chandeleur Sound off St. Bernard Parish. Other large tracts offered are in the Southwest Pass area of Plaquemines Parish, the bottoms area of Ascension Parish, and the Lake Bistineau area of Bossier and Bienville parishes.

Benzene Outlook

Output from oil high but substitutes may cut demand

F. Lawrence Resen

HOUSTON.—Benzene from petroleum will continue to find a market as a supplement for the lower priced but inadequate supply from coal tar, but cheaper substitutes for many chemical uses may curtail the demand in the future, according to Dr. Robert York of Monsanto Chemical Co., St. Louis.

This report was one of many on petrochemical processes and prospects presented in a series of panel discussions conducted by the South Texas Section of the American Institute of Chemical Engineers.

York predicted that the price of coal-tar benzene will rise above its present level of about 30 cents per gallon while petroleum benzene may drop a bit from around 47 cents but there will always be a substantial spread in production costs.

While this might appear to put petroleum benzene in a better competitive position, York pointed out that any general increase in its price to many types of consumers will incerase the possibility of other products being used as a substitute.

As examples, he cited the phenol-type plastics and styrene, both made from benzol, as major materials which could be supplemented by chemicals made from other sources. At competitive prices, vinyl and melamine plas-

I.P.E. OFFICIALS examine layout of exhibit area at Hall of Science.

AROMATICS SYMPOSIUM participants at the A.I.Ch.E. South Texas section meeting included these men. Left to right are J. R. Ghublikian and W. F. Wilkinson, Badger Process Division, Stone & Webster Engineering Corp., Boston; Dr. Robert York, Monsanto Chemical Co., St. Louis; Earl R. Weatherly, Sun Oil Co., Marcus Hook, Pa.; Ray A. Wilson, Shell Oil Co., Houston; M. C. Hopkins, Pan American Refining Corp., Texas City, presiding; and W. B. Franklin, chairman-elect, South Texas section, A.I.Ch.E.

tics could be substituted for the phenol types for many uses.

The next few years, York said, will see a continued high production of petroleum benzene, however, because production capacity was expanded from 10 million gallons annually in 1933 to 150 million gallons in 1952.

Sieve trays . . . Well-designed sieve trays in fractionating columns should be at least as efficient as well-designed bubble-cap trays, the meeting was told by Dr. F. Drew Mayfield and others who conducted experiments at the plant of Celanese Corp. of America at Bishop, Tex.

In the selection of trays by Celanese, preference over bubble trays was based on a combination of higher capacity, greater efficiency, and lower initial and maintenance cost.

The experiments showed that:

1. Sieve plates have approximately as wide range of stable tray operation as a bubble-cap tray operating under similar pressure drop.

2. The sieve tray should have equal or better film coefficients owing to somewhat better contact and lower froth density.

3. Wide range tray stability was demonstrated for sieve plate outlet weir settings of 4 in., with no indications that even higher weir settings would offer any difficulties.

NATIONAL AFFAIRS

Cartel Case Appealed

Companies ask Supreme Court to review question of change of venue, jury dismissal; win point on submitting records

Bertram F. Linz

WASHINGTON.—Companies fighting the Justice Department's grand jury investigation of an alleged international oil cartel filed a petition with the Supreme Court last week for review of the Circuit Court's decision refusing to dismiss the grand jury or transfer the case to New York.

Almost immediately thereafter the companies went before the District Court to argue their motions to quash or limit the subpoenas issued by the department, calling for the submission of records running back to 1928.

From Judge James R. Kirkland the companies quickly won their first point, that the period covered by the subpoenas was too long. After brief argument, Kirkland halved the period, changing the date from January 1, 1928, to January 1, 1941, but ruled the department may seek other subpoenas later for specific older documents that may be needed.

During the course of the argument, government counsel stressed the point that if the department were concerned only with getting an indictment against the companies it could have done so on the basis of the Federal Trade Commission's cartel report and the information it already had in hand, and intimated that the department was seeking to assure the companies a fair presentation before the grand jury.

Government argument . . . On the basis of the decisions holding that motions to dismiss or transfer the proceedings were premature *(The Oil and Gas Journal, October 27, page 77)*, department attorneys argued that the companies have no legal grounds on which to attack the proceedings, contending the time and place to ask for dismissal of the case, change of venue, and other matters would be when a case came up in the trial court.

The companies charged that the demand for millions of documents imposed an oppressive burden upon them, since the records were scattered all over the world. They also said that official secrets of foreign governments may be involved.

The department's argument was tempered by the comments of Judge Kirkland when he ruled on the motion to dismiss or transfer the case, that he was impressed with the hardships the companies would face in being required to bring such a great number of documents and witnesses to Washington.

Kirkland also told the department it should think twice before going ahead with the case in Washington, warning that no judge was likely to allow it to present detailed evidence covering a period of 24 years.

Basis for appeal . . . "The attorney general's selection of the District of Columbia forum for the conduct of these grand jury proceedings, when it was unfair, burdensome and unnecessary to do so, was a misuse of the court's power to convene special grand juries in the public interest," the companies asserted in their petition for Supreme Court review.

Pointing out that 8 of the 23 grand jurors are employes of federal agencies having a direct interest in the case, the companies argued that even though federal employes are eligible for jury service in the District of Columbia "they are obviously less likely to be completely impartial in the circumstances of this case than ordinary private citizens."

The department defended its action in Washington on the ground that "overt acts" occurred here, but the companies pointed out that the vital center of the activities constituting the alleged conspiracy was in the southern district of New York, where most of

the companies have their principal offices.

Referring to the international character of the proceedings, the companies' brief pointed out:

"Because of the special circumstances of their business abroad, the return of an indictment in this proceeding may well place in serious jeopardy the arrangements under which petitioners conduct their foreign operations. The subject matter of the special grand jury proceeding involves important international relationships in highly sensitive areas of the world. The mere institution of these proceedings has already caused adverse criticism of petitioners in the foreign press and radio, particularly in Middle East and South American countries. In these areas, this matter is already the subject of propaganda adverse to petitioners in the conduct of their business abroad. Moreover, the proceedings have already become the subject of serious concern to at least one foreign government with which all of the petitioners have important direct or indirect business relationships.

"These facts emphasize the vital importance to petitioners of having the question of indictment determined by a fair and impartial jury, free of the inevitable bias of government-employed jurors in the special circumstances of this case."

Alkylate Output Up

20,000 bbl. daily of idle capacity restored to duty

WASHINGTON. — Energetic efforts of the Petroleum Administration for Defense have reduced idle alkylate capacity from almost 30,000 bbl. daily last summer to 10,000 bbl. daily at the present time.

PAD officials, however, see little possibility of further reduction because of the fact this 10,000-bbl. capacity, split among a number of refiners, could be used only at uneconomic cost which would be acceptable only in the event of an emergency.

PAD's refining division, under Director William W. Keeler, has been actively working on the alkylate problem with refiners in an effort to keep aviation gasoline production up to military demand. For the past several months it has been concentrating on the matter of getting the idle alkylate capacity to work, by encouraging arrangements for the transfer of olefins from refiners who have a surplus to refiners who were short of supply to operate their alkylation facilities to full capacity.

The additional production thus made possible has been a substantial contribution to military requirements, but officials emphasize that the situation is still tight and that efforts must be continued to bring in additional capacity.

Steel Allocated

261,527 tons slated for first-quarter operations

WASHINGTON.—A total of 261,527 tons of oil-country tubular goods has been made available to oil and gas operators for first-quarter use under primary allocations announced by the Petroleum Administration for Defense.

Priorities assistance for that amount of casing and tubing has been granted to 1,804 operators. Another 794 applications for tubular goods were denied allocations on various grounds.

While the first-quarter primary allocation is about the same as that for the third quarter of this year it represents only 30 per cent of the 868,830 tons which PAD calculated operators would need to carry on their planned drilling programs and replenish inventories depleted during the steel strike, Acting Deputy Administrator C. Eugene Davis said.

The allocation total is about 80 per cent of the tonnage of casing and tubing expected to be available for the first quarter of next year. Supplemental allocations will be made from the remainder, and PAD also will grant priorities assistance on tubular goods to be produced from conversion steel.

Emergency stocks . . . In addition to the allocations, 22,200 tons of tubular goods will be earmarked for emergency field stocks for drilling of wildcat wells and other emergency uses. In addition, PAD issued authorizations last September to 402 operators for the purchase in the first quarter of 16,505 tons of drill pipe.

A breakdown of the allocations shows that 2,430 "A" operators, who normally drill 40 or fewer wells a year, applied for tubular goods and 1,652 were allotted a total of 97,917 tons. A total of 149 "B" operators, who drill more than 40 wells a year, filed applications and 140 of them received 162,569 tons. Twelve of 17 other operators received 1,041 tons for the drilling of brine, sulfur, and other miscellaneous wells. No allocations were made for the current quarter because of the steel strike.

For the third quarter, 1,399 "A" operators received allocations of 96,017 tons and 133 "B" operators received 166,170 tons.

Products Exports Increase

WASHINGTON.—Exports of major products increased more than a third during the week ended October 3, averaging 211,300 bbl. daily, according to Petroleum Administration for Defense statistics. A corrected report for the preceding week showed exports of 148,100 bbl. daily.

The higher level of exports was due primarily to an increase in shipments of distillate, which again exceeded the 100,000-bbl. daily mark. There was also an increase in motor-gasoline shipments, but aviation gasoline, kerosine, and residual all showed declines.

Detailed figures of the movement for the week ended October 3, compared with the preceding week, and average for the 4 weeks ended October 3 are shown in the accompanying table, in thousands of barrels daily.

	—Week ended—		Average
	Oct. 3	Sept. 26	4 weeks
Aviation gasoline	22.9	33.6	41.9
Motor gasoline	33.5	5.9	15.3
Kerosine	29.0	29.9	22.5
Distillate	111.3	60.7	90.7
Residual	14.6	18.0	36.4
Total	211.3	148.1	206.8

Steel Clampdown

Tubular goods made from imported steel restricted

WASHINGTON.—Oil-country tubular goods produced from imported steel was placed under full control last week by the National Production Authority.

In an order issued and effective on October 28, NPA prohibited operators from acquiring such goods except under an authorized controlled material order.

Another order issued simultaneously sets up the conditions under which oil and gas operators will be permitted to trade or exchange oil-country tubular goods or line pipe.

The order putting conversion goods under the Controlled Materials Plan was issued as Direction 6 to Order M-46, providing priorities assistance for operators in the United States and Canada, and Direction 4 to Order M-46A, covering foreign oil and gas operations. Trades and exchanges were covered by Direction 7 to M-46 and Direction 5 to M-46A.

Why action was taken . . . Officials explained that since operators must now keep the two agencies advised as to the facts of particular conversion arrangements it will be possible to develop additional sources of conversion production without interferring with

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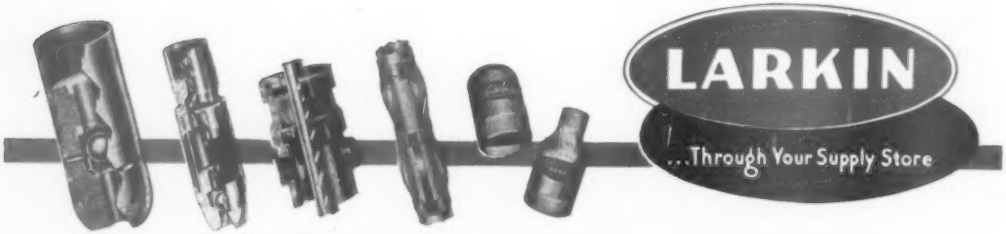


Geyser Cementing Shoes | Cementrol Equipment | Forged Steel Heads | Centralizer | Bull Plugs And Nipples

regular mill production of oil-country tubular goods.

The new directions provide that "notwithstanding the provisions of any NPA order or regulation no petroleum operator shall take delivery of any new oil-country tubular goods produced or finished in the United States after the effective date of this direction from semifinished conversion steel . . . except pursuant to an authorized controlled-material order."

Shell Oil Charged by FTC

WASHINGTON.—The Federal Trade Commission has resumed its campaign against the oil industry, this time charging Shell Oil Co. with enforcing exclusive contracts upon its dealers.

The commission charges Shell with restraint of trade in violation of Section 3 of the Clayton Antitrust Act. It has given the company 20 days in which to file an answer and has scheduled a hearing on the complaint for December 19.

In its complaint FTC charged that commencing sometime in 1951, Shell inaugurated a marketing plan whereby sales and contracts for sales of its kerosine and fuel oils to independent dealers are made only on the condition that they handle the products of no other company.

The commission also alleged that the company's sales contracts require dealers to adopt and use the color scheme, trade mark and trade name of Shell on all delivery equipment; refrain from selling and delivering kerosine and fuel oils other than Shell's under its trade name, and purchase from Shell specified minimum quantities of kerosine and fuel oils.

I.P.A.A. Price Appeal Denied

WASHINGTON. — Appeal of the Independent Petroleum Association of America for the suspension of price controls on crude oil again was turned down by the Office of Price Stabilization last week.

In a letter to Russell B. Brown, I.P.A.A. general counsel, Price Director Tighe Woods asserted that the industry application failed to show that oil could qualify for decontrol under the OPS standards, which require that a product must be selling well below ceilings with no indication that the price will rise substantially in the foreseeable future.

Woods challenged Brown's assertion that price controls were limiting production, asserting that present ceilings are not a barrier to the expansion of crude capacity.

ROCKY MOUNTAIN

New Socony Unit

Clawson to direct activity in Williston, Rocky areas

CASPER, Wyo.—Socony-Vacuum Oil Co., Inc., has set up a new exploration and production organization with temporary headquarters here to conduct operations in the Williston basin and northern Rocky Mountain regions.

The move, announced last week by the company, was made to increase operating efficiency by coordinating the programs of the several Socony subsidiaries now active in these areas.

The new organization also will coordinate operations of Socony-Vacuum Exploration Co., a wholly owned affiliate operating in western Canada, with those of companies operating on this side of the border.

Personnel . . . William W. Clawson, up to now chief geologist of Magnolia Petroleum Co., another Socony affiliate, will be general manager of the new organization and president of Socony-Vacuum Exploration.

W. M. CLAWSON

J. W. CLARK

A. F. Barrett, now manager of the Rocky Mountain Division of General Petroleum Corp. at Casper, Wyo., will serve as area manager of production. H. R. Moorman, now vice president and manager of Socony-Vacuum Exploration at Calgary, will become executive vice president of this firm and will continue as manager of Canadian operations.

Magnolia, which operates principally in the Mid-Continent and Gulf Coast areas, up to now has been responsible for conducting operations in the eastern portion of the Williston basin in the United States. General Petroleum, an affiliate which concentrates chiefly on the West Coast, has been active in the western United States part of the basin and in the northern Rocky Mountains. General Petroleum's personnel in this area will form the nucleus for the new unit.

Replacing Clawson as chief geologist for Magnolia will be John W. Clark, assistant chief geologist for 8 years.

Big Strike Indicated

Hiawatha's rank test flows at rate of 1,560 bbl. daily

DENVER.—What is believed to be Colorado's most prolific oil well and this year's biggest discovery anywhere in the Rocky Mountain region continued to test last week.

The well is the M. E. Davis 1 State, a rank wildcat drilled by Hiawatha Oil & Gas Co.

During a 10-hour test last week the well flowed oil at a rate of 1,560 bbl. daily through a ½-in. choke from 6,889-6,913 ft. in the First Frontier sand. Previously the operator had experienced considerable lost-circulation trouble and mudding up of the producing formation.

The well finally kicked off and began flowing after treatment with 5,000 gal. of acid. It also was reported flowing substantial quantities of sweet gas.

Location of the strike is 36-7n-81w, on the Coalmont anticline in the North Park basin within a few miles of the towns of Coalmont and Walden. The structure was mapped by Hiawatha.

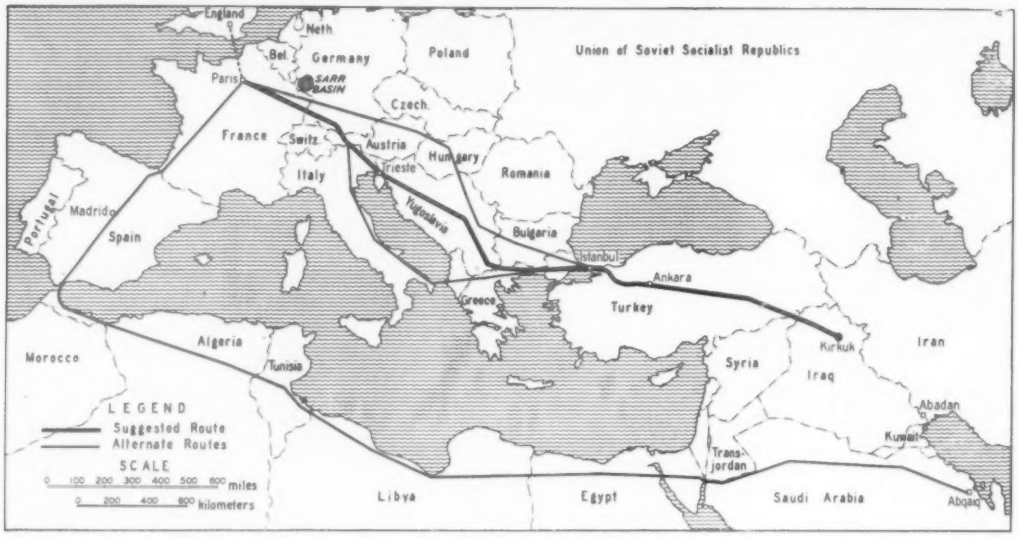
Ray Thompson, Hiawatha division manager, said the company has 1,500 acres on the structure and more in the surrounding basin. The Coalmont anticline, he said, in reality should be termed the Coalmont nose. He described it as a north-plunging nose faulted off on the north end.

Rankest wildcat . . . Before the well hit pay, the venture was called by oil men in this area the "rankest kind of wildcat." The North Park basin, a small intermontane basin, is surrounded on all sides by granite outcrops. The man responsible for drilling in the basin was M. L. Benedum. Hiawatha is a subsidiary of Benedum - Trees Oil Co., which is headed by Benedum.

Four more locations offsetting the discovery have been staked in the Walden - Coalmont area, Thompson said. These will be drilled as soon as possible in an effort to throw some light on size of the pool.

First indication on a major discovery came 3 weeks ago when the wildcat flowed 35 bbl. per hour in a drill-stem test from 6,889-6,913 ft.

Surprisingly, the big producer was the first well ever drilled by Hiawatha in Colorado.



Huge Line Proposed

Fabulous gas system capable of moving billion cubic feet daily from Iraq fields to Paris outlined by Bechtel head

Dahl M. Duff

THE possibility of utilizing the natural-gas production of the Middle East by construction of a 2,500-mile overland pipe line to Paris and Western Europe has been advanced by the head of one of the country's leading engineering organizations.

S. D. Bechtel, president of Bechtel Corp., this week is making public a preliminary economic and engineering study which he had made on such a project more than a year ago.

The magnitude of the undertaking would exceed anything yet built in the pipe-line field in the United States or abroad. Bechtel's preliminary plan envisages 1,800 miles of 34 and 36-in. and 700 miles of 24 and 26-in. line, with an over-all total of 15 compressor stations. The preferred route leads across Turkey, Greece, northern Italy, Switzerland, and southwestern Germany.

While the report deals with the soundness of the plan from an engineering and commercial standpoint, the political obstacles involved seem almost insurmountable. Bechtel's report recognized these political problems but said it was felt they could be overcome because of the many benefits which could be realized by all countries.

Background . . . Bechtel's study arose out of an idea originally suggested by Earl F. English, vice president of Bechtel International Corp. The preliminary report was completed in March of last year and has heretofore been given limited private distribution.

More recently some European government officials and the Organization for European Economic Cooperation (O.E.E.C.) have become interested in the scheme and asked for copies.

While there are no plans for undertaking the project, the report stands as an example of "down-the-road" pipeline thinking and an indication of what could be accomplished on the basis of engineering feasibility.

Several other startling pipe-line proposals have been talked during the last few years. One was for a gas line from southern Mexican fields under the Yucatan Channel to Cuba and then across to Florida. More serious consideration has been given to a crude line which would extend northward from France's Mediterranean coast through western Europe and thus avoid the tanker haul around the Spanish Peninsula.

What it would mean . . . There is no question that if such a line as Bechtel has proposed could be built and placed in operation, it would revolutionize the fuel supply of Europe. It was estimated that the maximum delivered cost of gas in the pipe-line system would be 32 cents per M.c.f. The report said natural gas from the Middle East could be made available at any point in such a contemplated pipe line at a price lower than present solid-fuel prices and at a material saving below present manufactured-gas prices. The gas made available also could lead to the development of a chemical industry based on the fuel.

Bechtel said he had been impressed with the opportunities such a line might offer to many nations when it was first suggested by members of his organization. As a result he asked his technical staff to develop their ideas and estimates. The Bechtel organization, which has headquarters at San Francisco, with affiliates both in the United States and abroad, engages in engineering and construction in a number of industrial fields, including railroads, highways, tunnels, bridges, dams, pipe lines, power plants, refineries, and chemical plants. In the Middle East, it built the 30-32-in. Iraq Petroleum Co., Ltd., crude line and about four-fifths of the 30 and 31-in. trans-Arabian line.

The main suggested route for the proposed Middle East-to-Paris gas line would originate in Kirkuk field in Iraq. However, it pointed out that other Middle East fields, though more distant, also have substantial gas production associated with the oil which must now be flared because of lack of market and outlet. These include the fields in

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POWER THAT PAYS

Preliminary Cost Estimate of Main Pipe-Line System*

Item—	Unit cost Stage I	Total cost Stage I	Total cost Stage II	Total cost Combined
Pipe, ton	$ 125	$106,000,000	$106,000,000	$212,000,000
Ocean freight, ton	25	25,000,000	24,500,000	49,500,000
Pipe-line construction, includes hauling, treating, etc., per mile	50,000	125,000,000	95,000,000	220,000,000
Compressor stations complete, each	5,000,000	75,000,000	60,000,000	135,000,000
Communications and operating facilities		7,500,000	3,500,000	11,000,000
Right-of-way, mile	5,000	12,500,000		12,500,000
Contingencies	10%	35,000,000	29,000,000	64,000,000
Engineering, purchasing and overhead	10%	39,000,000	32,000,000	71,000,000
		†$425,000,000	$350,000,000	$775,000,000

*Assuming two parallel pipe lines built in two stages, each with a capacity of 500,000,000 cu. ft. per day. Size and quantity of pipe assumed in each line: 1,800 miles of 34 and 36 in. totaling 670,000 tons, and 700 miles of 24 and 26 in. totaling 180,000 tons, or a total requirement for each line of 2,500 miles or 850,000 tons. †Divided $250,000,000 materials and freight, and $175,000,000 construction costs.

southern Iraq, Kuwait, and Saudi Arabia.

It was assumed in the study that the initial system would be built in two stages: (1) a single line with the necessary stations, and (2), an additional duplicate line with increased compressor plant capacity. With the first 1,800 miles a combination 34 and 36-in., and the last 700 miles a combination 24 and 26-in., along with 15 stations, the line would deliver 500 million cubic feet of gas daily. A double line would move one billion cubic feet daily.

Alternate routes . . . From the preferred and most practical route, the report said, it would be possible to reach practically all the industrial centers of Europe by branch lines averaging less than 300 miles.

For the main line, two alternative routes were proposed but it was noted these might lead to severe construction and maintenance problems since the pipe would have to be submerged to a depth of about 3,000 ft. The alternate route across North Africa would be about 5,000 miles in length and the main portion would be through sparsely settled, undeveloped countries offering little present market for gas sales.

"The accomplishment of this project has been considered as an international or United Nations undertaking," the report said. "It also is assumed that in the various countries the private utility interests, or national, as they may be, will participate in the undertaking at least to the extent of financing and constructing the necessary branch lines from the main system to the centers of population and industry in those countries.

"Advancements and experience in the design and construction of very large diameter and long-distance pipeline projects during the past several years make the project entirely sound in engineering conception and practical of accomplishment."

The study estimated that completion of the finished line could be assured within a 3-year period. It pointed out the possibility of manufacturing 34 and 36-in. pipe on a production-line basis in the steel-plate producing countries of Europe, and said the compressor equipment also could be produced in Europe.

Probable costs . . . The cost figures given in the report are now somewhat out of date because of rises in materials prices since it was prepared. However, on the basis of prices at that time, it was estimated stage one with the single line could be built for $425,000,000, and the second stage, with the duplicate line, for an additional $350,000,000.

With a 20-year amortization period and interest charge of 4 per cent, it was estimated that total annual charges and costs, including system maintenance and operation, would approximate $34,000,000 (see Table 2). The estimated delivered cost of gas of 32 cents per M.c.f. was based on purchase in the field of 3 cents, 22 cents transmission costs, and 7 cents branch-line transmission costs.

Main-line costs are shown in the accompanying table. The branch-line figure of 7 cents per M.c.f. was based on the assumptions that the average branch line would be 300 miles long and 24-in. in diameter, would deliver 150,000,000 cu. ft. per day, and would require an investment of $35,000,000. The 7-cent cost allowed for construction of one pump station, and is based on the same financing charge as for the main line and on a cost of 20 cents per M.c.f. for station fuel.

ESTIMATED POSSIBLE DELIVERED COST OF GAS FOR A SINGLE LINE*

Annual charges and costs:	
$425,000,000 at 2 per cent	$ 8,500,000
Amortization	21,250,000
System maintenance	1,500,000
Operation	1,500,000
Station fuel (at field cost)	500,000
Administration	750,000
Total annual costs	$34,000,000
Average main line cost per M.c.f.	$.22
Assumed field purchase price gas	.03
Delivered cost per M.c.f.	$.25

*Assuming amortization by equal annual payments over a period of 20 years and interest charges of 4 per cent on outstanding indebtedness or average interest rate of 2 per cent on the total investment. Assuming, also, a load factor of 90 per cent.

Labor Study Asked

Workers, employers divided on reduction in work hours

A RESOLUTION calling for a study of present working hours in the international petroleum industry was adopted by the Petroleum Committee of International Labor Organization at its recent meeting at Scheveningen in the Netherlands.

Labor-union representatives at the meeting of the United Nations-affiliate organization sought unsuccessfully to have the subject of reduction of working hours definitely placed on the agenda of the next meeting in Caracas, Venezuela, in 1954.

The Scheveningen meeting produced a split between employer and union delegates on the subject. At its second meeting in Geneva in 1948, the committee passed a resolution favoring the 40-hour week as a desirable goal to be reached in the industry when economic conditions permit. At the Scheveningen meeting, the union representatives contended that the time had come for action on this resolution.

Employer delegates argued that a shortage of manpower prevented such action at this time and contended that the petroleum industry would have to consider what conditions prevail in other industries. They were supported by the British Government delegates in this position.

The compromise resolution which was passed was offered by Robert B. Behlow, New York regional director of the Bureau of Labor Statistics who was a U. S. Government delegate. It asked the I.L.O. governing body to study working hours with a view toward placing the subject on the agenda of a future session of the committee.

The question of working hours in the industry was the only subject brought up at the meeting which resulted in any controversy. The committee passed several other resolutions unanimously. These provided for initiating a study of contract labor in the industry and consideration at a future meeting; further study of the

New Trinidad Fluid Cat Cracker

This new unit was the main part of the expansion program carried out over a 2-year period at the Point-a-Pierre refinery of Trinidad Leaseholds, Ltd., in Trinidad. It is the recently completed 15,000-bbl. per stream day fluid catalytic cracking unit. The modernization program for the refinery also comprised a vacuum unit, gasoline treating facilities, and a gasoline rerun unit. Foster Wheeler, Ltd., was the main contractor; Universal Oil Products Co. handled process design. The refinery has a crude capacity of about 70,000 bbl. daily.

subject of industrial relations in the industry; and discussion of human relations in the industry as a part of the agenda of a future session.

Cosden Offered Loan

The Puerto Rican Development Bank has offered a $3,250,000 loan to Cosden Petroleum Corp., Big Spring, Tex., which has been considering the construction of a modern new refinery on the island.

Reports from San Juan said Cosden had indicated it would raise half the estimated $6,500,000 investment required for the project. In announcing the loan offer, the bank said it was contingent on a study to determine if the operation promises to be profitable, if a crude oil supply can be assured, and if the excess refinery production can be sold in the United States. The loan offer will stand until December 15 by which time the deal must be completed.

Cosden was first reported to be considering a Puerto Rican refinery project a year and a half ago. Capacity planned at that time was 12,000 bbl. daily with Venezuelan crude as feedstock. The company took an option on a 120-acre site about 2½ miles from deep water in San Juan Bay.

Italian Projects Under Way

Several projects designed to expand the capacity and improve the facilities of the refining industry in Italy are now under way in that country.

The outstanding projects are the new refineries being built in the Milan area, one the 30,000-bbl. daily plus Condor plant at Rho and the other the Caltex-Fiat refinery at San Martino di Trecate. The Condor refinery is to go into operation early next year; the Caltex-Fiat plant of about 13,500 bbl. daily capacity will be placed on stream later this year.

Also to be inaugurated during the first quarter of next year are the new Duo-Sol lubricating-oil plant in the Stanic refinery at Leghorn, the new catalytic cracking plant under construction at the Falconara (Ancona) refinery of Azienda Petroli Italiani, a new distillation unit at the Augusta (Syracuse) refinery of RASIOM, and other new distillation equipment at the Fiorenzuola d'Arda refinery of Petroli d'Italia. Another project under construction is the Mantua refinery operated by a joint Italo-French firm and which, according to reports from Italy, is negotiating a cooperative agreement with Esso Export Corp.

In order to keep these plants operating at full capacity, leaders of the Italian refining industry have asked the Italian Government to grant facilities for the export of motor fuel since the Italian market is not able to absorb the entire gasoline production of the country's refineries.

British to Get Premium Fuel

Beginning next February, British motorists will be able to buy premium grade motor fuel for the first time since September 1939.

The British Ministry of Fuel and Power announced that present restrictions limiting the oil companies to marketing a single grade with a minimum of 70 octane and a maximum of 72 will be ended February 1.

The companies will continue to sell the standard grade at the controlled price which is equivalent to about 49½ cents per U. S. gallon. However, they will be free to sell the higher grade at an octane and at a price which will be competitive. It was believed the premium grade which will be placed on the market will cost about three pence (3½ cents) additional.

Creole to Spend More in '53

Creole Petroleum Corp. expects to step up its capital expenditures in Venezuela next year by about 25 per cent.

A. T. Proudfit, Creole president, said recently in Caracas that the company capital budget for 1952 approximated $80,000,000 and that plans call for a total investment in 1953 of about $100,000,000.

Creole, the principal operator in Venezuela, is known to have several important projects under consideration. The company was recently reported to be planning a major expansion of its Amuay Bay refinery at a cost of $35,000,000 to $40,000,000.

Germans Set Record

West German operators established a new record in June by drilling a total of 45½ km. (about 149,000 ft.)

The June footage was at an annual rate of nearly 1,800,000 ft. a year. The previous monthly record was in March with a total of 43.3 km.

During the first half of this year, the total drilled in West Germany amounted to 234,252 m. (about 770,000 ft.) against 184,439 m. in the corresponding period of 1951.

Field wells accounted for 23,416 m. of the total drilled in June. A considerable proportion of the June drilling was in extension wells with a total of 13,025 m. Wildcat drilling totaled 9,065 m.

PERSONALS

Top Geophysicist

S.E.G. head is authority on offshore seismic work

CURTIS H. JOHNSON, president of the Society of Exploration Geophysicists, is one of the leaders in the field of offshore seismic operations.

As the assistant chief geophysicist for General Petroleum Corp., Los Angeles, he has represented the company the past several years in jointly conducted seismic operations off the coast of southern California. He is the author of several papers on offshore seismic exploration along the Pacific Coast.

Johnson currently is presenting a paper on "Professional Responsibility" to various geophysical groups throughout this country and Canada. He was one of the organizers of the Pacific section of the S.E.G. and served as its first president.

Following graduation from the University of California at Los Angeles, he did postgraduate work in acoustics there. From 1933 to 1938 he was geophysicist and later chief geophysicist for Rieber Laboratory. He joined General Petroleum in 1939 as an assistant geophysicist, and after a series of promotions was elevated to his present position in 1951.

He also is a member of the American Association of Petroleum Geologists, the American Geophysical Union, and the Offshore Seismic Operations Committee of the Western Oil and Gas Association.

Johnson is a native of Salt Lake City. He makes his home in San Marino, Calif., where he is active in community and Boy Scout work.

W. N. Easley has been appointed district geologist for Sunray Oil Corp. at Corpus Christi, effective December 15. At present Sunray has only a district production office in Corpus Christi but is moving its exploration and land department offices there from San Antonio. In another consolidation, Sunray has moved its Houston exploration and production offices to Lake Charles, La. **Bert Timm** has been named district geologist in charge of the Lake Charles exploration office and **A. E. Hoffman** superintendent and manager of production there.

A. L. Fabens, Jr., has been appointed assistant general manager and production manager in the Ramset division of Olin Industries, Inc.

Hollis D. Hedberg has been named chief of the geology and geophysics section of the land and exploration branch of Gulf Oil Corp.'s production department at Pittsburgh. Other appointments there include; **Robert L. Boggs,** as assistant to the vice president of the production department; **H. J. Wharton,** as chief exploitation engineer, and **A. H. Stoecker,** named chief of the economics section. Previously all four men were associated with the company's foreign production division at New York.

H. H. Bradfield has resigned as senior geologist in the general offices of The Texas Co. at Houston to join the firm of L. O. McMillan, Dallas oil operator. Before serving in Texaco's Houston office this past year he spent 13 years in the company's West Texas producing division.

L. B. Dunn, who has been president of International Radiator Co. at Fort Worth the past 2 years, has been named vice president of Fort Worth Exploration Co.

J. P. Coleman, McCarty & Coleman, Wichita Falls, Tex., has been elected president of the National Stripper Well Association. Officers were elected at the annual meeting held during the Independent Petroleum Association of America convention in Oklahoma City October 23-24. Coleman succeeds **John Paul Jones,** Bradford, Pa., who became a director. Other new officers are: **David Scott, Jr.,** Ryder Scott Co., Bradford, first vice president; **H. M. McClure, Jr.,** independent operator, Alma, Mich., second vice president, and **Fred Sehmann,** Wichita Falls, executive secretary of the North Texas Oil and Gas Association, reelected secretary-treasurer.

Richard L. Zimmerman, petroleum engineer for Houston Oil Co. of Texas, has been transferred from Houston to Beeville, Tex.

W. E. Reed, drilling superintendent for Stovall Drilling Co., Inc., has been transferred from Satanta, Kans., to Monroe, La.

A. P. Haws, tool pusher for Penrod Drilling Co., has been transferred from Snyder, Tex., to Tahoka, Tex.

Arthur L. Jenke has been named district geologist for Fain & McGaha Oil Producers in the company's new offices at Abilene, Tex. Jenke, who was graduated from Washington University, formerly was employed 7 years by the U. S. Geological Survey.

R. E. Winge, district superintendent for Mid-Continent Petroleum Corp. at Seminole, Okla., has been promoted to state superintendent at Oklahoma City.

Fred Carr, British-American Oil Producing Co., has been elected president of the Wyoming Geological Association for 1953. Other new officers are: **Jim F. Fouts,** Baroid Well Logging Service, first vice president; **R. P. Swirezynski,** Sohio Petroleum Co., second vice president; **Charles J. McGinnis,** The California Co., treasurer; and **Murray J. Cliff,** Pure Oil Co., secretary. Honorary memberships have been voted to **John R. Fanshawe,** Billings, Mont., consultant, and **G. W. Berry,** Sun Oil Co., Denver, for their contributions in the field of geology.

A. T. Guernsey has been transferred from Hobbs, N. M., to Midland, Tex., as area reservoir engineer for Shell Oil Co. Other Shell changes involve: **J. A. Connors,** promoted from mechanical engineer to district foreman at Hobbs; **R. L. Geer,** promoted from junior mechanical engineer to mechanical engineer at Hobbs; **T. W. Hollis,** TXL field production foreman, appointed drilling foreman at Odessa, Tex.; **D. F. Jahns,** head roustabout at Eunice, N. M., promoted to mechanical engineer at Hobbs; **E. W. Nestor,** exploitation engineer, transferred from Midland to Hobbs; **J. E. R. Sheeler,** area mud engineer at New Orleans, promoted to division

PERSONALS

exploitation engineer at Odessa; **F. W. Stewart,** drilling foreman, transferred from the Calgary, Alta., area to Odessa.

Don W. Danz, geophysicist for Stanolind Oil & Gas Co., has been transferred from Midland, Tex., to Roswell, N. M.

Douglas H. Elliott, a division photogeologist for Stanoling Oil & Gas Co. at Casper, Wyo., the past 2 years, has joined Bruce Anderson, independent operator, and Eagle Oil Co., Casper.

Jim Blackwell, assistant division manager for The Texas Co. at Denver, has been promoted to manager of operations for Western Hemisphere foreign production with offices in New York.

A. L. Bergren, Jr., has been appointed regional geologist for Lion Oil Co. at Denver.

Bill Hudson has resigned as a geologist for British-American Oil Producing Co., Denver, to manage operations for **Ralph E. Fair,** San Antonio independent, in the Rocky Mountain region. Prior to joining British-American Hudson was a Rocky Mountain geologist for The California Co.

J. E. McCauley has been named president of New World Oil, Ltd., a new Canadian firm. He and **Philip Lieberman,** vice president, will have their headquarters in Edmonton, Alta. **Jack Yetman,** executive vice president, and **Courtland Dietler,** vice president, will be located at Denver. The firm will operate in Canada and the Rocky Mountain region.

Hugh E. Palmer, Bismarck, N. D., independent operator, has formed Cardinal Drilling Co. there.

Irwin R. Chalmers, junior production engineer for Pan American Production Co., at Charenton, La., has been promoted to production engineer at Houston.

Owen R. Smith has been named president of the newly organized Kentucky Oil & Gas Corp. Other officers are: **L. F. Smith,** Wichita Falls, Tex., and **Harry W. Kahn,** New York City, vice presidents; **Dr. T. P. Chow,** New York City, secretary-treasurer, and **Eugene H. Walet, Jr.,** New Orleans, and **Sol Karp,** New York, directors.

C. C. Dye, petroleum engineer for Quintana Petroleum Corp., has been transferred from Victoria to Cotulla, Tex.

Bill Nissen, field foreman for British American Oil Producing Co. at Midland, Tex., has been appointed production foreman at Grayville, Ill.

Robert A. Kent, exploitation engineer for Shell Oil Co. at Long Beach, has been transferred to Bakersfield, Calif.

Hubert J. Monroe, drilling superintendent for Delta Drilling Co., has been transferred from Vernal, Utah, to Craig, Colo.

Teddy Royce Hancock, petroleum engineer for Magnolia Petroleum Co. in its Falfurrias, Tex., district, has been appointed assistant production foreman there.

R. G. Follis, chairman of the board of Standard Oil Co. of California, has been appointed a director of the National City Bank of New York. He also is a director and vice chairman of the board of Arabian American Oil Co. and chairman and director of Trans-Arabian Pipe Line Co.

Fred M. Clement, assistant regional production manager for Continental Oil Co. in the Rocky Mountain area, has been promoted to regional production manager at Oklahoma City. **Wayne E. Glenn,** regional petroleum engineer at Houston, will replace Clement at Denver November 15.

Bill J. Graham, engineering trainee for Sohio Petroleum Co. at Pauls Valley, Okla., has been promoted to junior engineer.

Ray A. Burke, district geologist for Union Oil Co. of California, has been transferred from Corpus Christi to New Orleans.

W. K. Hastings, seismic party chief for Gulf Research & Development Co., has been transferred from Big Spring to Odessa, Tex.

W. J. Amis, division geologist for Shell Oil Co. at Tyler, Tex., has been transferred to Corpus Christi. Other company changes involve: **W. R. Cobb,** subsurface geologist at San Antonio, appointed area geologist at Houston; **R. P. Maner, Jr.,** stratigrapher at Tyler, promoted to junior geologist; **J. R. Rehbein, Jr.,** mechanical engineer at New Orleans, promoted to division mechanical engineer at Houston; **J. S. Rives,** subsurface geologist at San Antonio, appointed field geologist, and **H. R. Thompson,** division production geologist at Houston, transferred to the New Orleans area.

Fred H. Ramseur, Jr., superintendent of Arkansas Fuel Oil Co.'s Waskom natural-gasoline plant, has been appointed acting superintendent of the company's natural-gasoline division. He replaces **James Britt,** who has resigned.

BROWNSCOMBE

Dr. E. R. Brownscombe, Atlantic Refining Co., Dallas, was elected chairman of the North Texas section, American Institute of Mining and Metallurgical Engineers, for the coming year. Other officers named at the section meeting, held in Fort Worth October 27, were **R. T. Bright,** Mercantile National Bank, Dallas, vice chairman; **Rollie P. Dobyns,** Bureau of Mines, vice chairman for the Wichita Falls local section; **Tom Morton,** Halliburton Oil Well Cementing Co., Dallas, secretary-treasurer; **Allen Gibson,** Magnolia Petroleum Co., and **Robert B. Gilmore,** DeGolyer & MacNaughton, Dallas directors. Wichita Falls directors named were **R. G. Parker** and **B. J. Miller.** Fort Worth members voted to form a local section, naming **Henry J. Gruy,** consulting engineer, as chairman. **R. W. Erwin,** Salt Water Control, Inc., and **Roy T. Durst,** Rowan Drilling Co., were elected vice chairmen; **Tom Curtis,** Stanolind Oil & Gas Co., was made secretary-treasurer and **R. G. Parker,** Continental Oil Co., was made section delegate and director.

J. S. Bell, Henry Black & Sons Drilling Co., Midland, Tex., has been elected 1952 chairman of the Permian Basin chapter of the American Association of Oilwell Drilling Contractors. He succeeds **J. W. Hall,** Trinity Drilling Co. who was recently named vice president for West Texas and New Mexico by the national A.A.O.D.C. Other new officers are: **Jack Fogerson,** Carl B. King Drilling Co., Midland, vice president, and **Clyde McHam,** Rowan Drilling Co., Midland, secretary-treasurer.

PERSONALS

Gene C. Bankston, exploitation engineer for Shell Oil Co. at Elk City, Okla., has been promoted to reservoir engineer at Oklahoma City.

W. P. Lawrence, seismic party chief for Amerada Petroleum Corp., has been transferred from Artesia, N. M., to San Angelo, Tex.

L. V. Cassaday has been elected president of Lomita Gasoline Co. of Long Beach, succeeding **H. C. Judd.** Cassaday formerly was vice president and general manager. **J. E. Toussaint** was elected chairman of the board of directors and **T. L. Taggart,** vice chairman.

C. H. Reigner and **W. E. Thorn** have been promoted to head and assistant head, respectively, of the oil movement and storage divisions of Esso Standard Oil Co.'s Bayonne, N. J., refinery.

Thomas A. Matthews II, a research engineer for Pure Oil Co. at Crystal Lake, Ill., since 1946, has joined the chemical-engineering department of The Western Co., Midland, Tex.

Lowell Crabb, Wagner, has been elected president of the South Dakota Independent Oil Men's Association, succeeding **C. G. Skartvedt,** Rapid City. Vice presidents elected were **R. L. Aden,** Sioux Falls; **Marion Van Wyck,** Platte, and **A. J. Rhian,** Yankton.

Charles F. Hunkins has been appointed chief petroleum engineer in the oil development department of Northern Pacific Railway Co. He formerly was district superintendent for British American Oil Producing Co. at Bakersfield, Calif., and production engineer for Tide Water Associated Oil Co.

Louis M. Sherman has been appointed associate director of product development in charge of industrial chemicals for the Ethyl Corp. He will serve on the staff of William T. Hack, director of product development. For the past 6 years he has been associated with American Cyanamid Co., and its subsidiary, Chemical Construction Co.

Jack A. Vickers, Jr., son of the late Jack A. Vickers, Sr., founder of Vickers Petroleum Co., Wichita, will become president of the firm November 10. He has been with the independent enterprise since 1946, when he started in the scouting end of the business. **John S. Wertz,** president the past 4 years, will become chairman of the board of directors. **James Beattie Smith,** who has been vice president and a member of the board of directors since 1941, will become executive vice president.

E. G. Wiley and **P. T. Oak** have been appointed assistant general superintendents of the Standard Oil Co. (Ind.) refinery at Whiting, Ind. Wiley formerly was superintendent of the asphalt division and Oak was assistant superintendent of the heavy-oils division.

Kenneth E. Lowe, formerly a seismologist for Southern Geophysical Co., has joined Tide Water Associated Oil Co. at Midland, Tex. **Robert R. McConnell,** formerly with Stanolind Oil & Gas Co. in Louisiana, has been appointed assistant geologist for Tide Water in Jackson, Miss. Company transfers include **James P. Richards,** field engineer, from Kilgore to Scroggins, Tex., and **Omar L. Emrick,** field engineer, from Kilgore to Venice, La.

Frank Ficklin has been placed in charge of Rocky Mountain drilling and production activities of Hiawatha Oil & Gas Co. at Casper, Wyo.

Russell M. Lilly, assistant district superintendent for Humble Oil & Refining Co., has been transferred from the Stanton, Tex., to the Hobbs, N. M., production district.

E. G. Christianson, division exploitation engineer for Shell Oil Co. at Kilgore, Tex., has been appointed area exploitation engineer at Houston. Christianson, who began his career with Shell as an engineering trainee in 1938, served as division exploitation engineer at Franklin, La., before his transfer to Kilgore.

J. P. Moroney, formerly vice president and Rocky Mountain manager for Sinclair Oil & Gas Co., has been appointed vice president of Colorado Interstate Gas Co. and of the company's subsidiary, Colorado Oil & Gas Corp. The new subsidiary will handle all exploratory and producing operations for the firm and offices will be in Denver.

DEATHS

William M. Welch, 78, retired engineer and executive, died in Tulsa October 29. While vice president and manager of Tidal Gasoline Co. he helped organize the Natural Gasoline Association of America and served two terms as the association's first president from 1921 to 1923. He also was an organizer of the Natural Gas Department of the American Gas Association. He had been chief engineer for Mexican Eagle Oil Co., Tampico, and also had been associated with Kansas Natural Gas Co., Independence, during his career.

J. D. Baker, 54, purchasing agent for the central division of Stanolind Oil & Gas Co. at Oklahoma City, died there October 28.

George L. Machris, 73, independent oil operator, died at Palm Springs, Calif., recently. He was one of the founders of Wilshire Oil Co.

Howell Carnahan Cooper, 78, former president of Hope Natural Gas Co., Mississippi River Fuel Corp., and Colorado Interstate Gas Co., died October 27 in Pittsburgh. Cooper, a native of Oil City, Pa., retired in 1939.

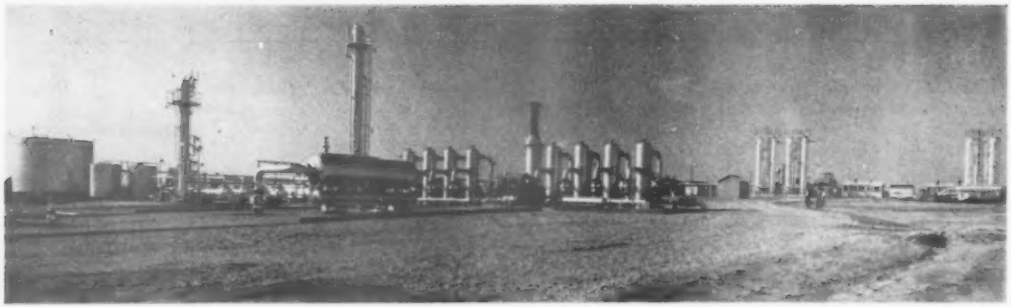
Charles Emmett Peacock, 74, former deputy conservation supervisor for the Texas Railroad Commission, died recently.

Robert L. Clifton, 64, former manager of the production department of Carter Oil Co., died in Tulsa October 28. He joined the company in 1917 as district foreman and played a major role in development of Burbank and Seminole fields. He retired in 1947.

John Bernsee Catlin, 63, for the past 10 years an oil specialist and analyst for Guaranty Trust Co., New York, died at his home in Sayville, Long Island, October 22.

James E. French, 86, pioneer Oklahoma rig builder, died in Tulsa October 24. A native of Troy, Pa., he came to Oklahoma in 1905.

Hugh Clay Allen, 81, formerly an accountant for Carter Oil Co., died October 25 in Tulsa.



OVER-ALL VIEW of Southern Natural Gas Co.'s Gwinville distillate reduction plant in Gwinville field, Mississippi. This installation removes distillate from the gas which is then delivered into pipe lines.

Southern Natural Removes Distillate . . .

. . . and increases pipe-line efficiency

**by L. N. Brown*
and J. M. Phillips†**

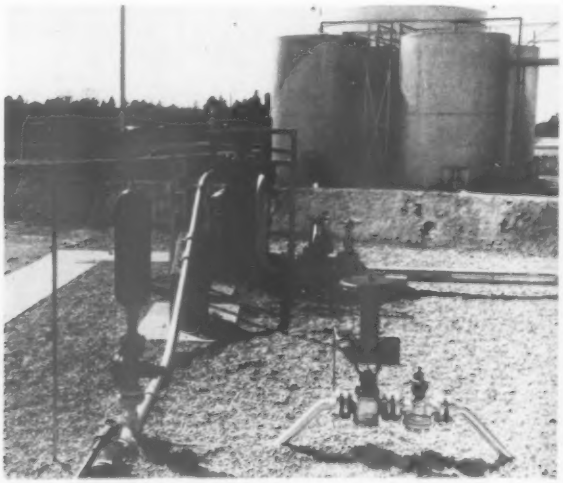
Absorption oil is injected in field lines as means of avoiding the expense of normal absorption equipment

SOUTHERN NATURAL GAS CO. in the first year's operation of its new 180-mile, 18-in. transmission pipe line discovered it was facing a serious problem from the condensation of liquid in the line and in the transmission system receiving gas from the line.

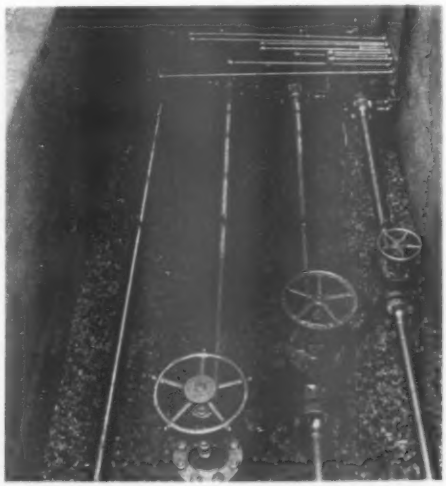
The line was built in 1950 and extends from Gwinville gas field in Central Mississippi to company's Elmore compressor station in Central Alabama. At that point gas is delivered into a 16-in. pipe line which extends eastward to a point near Macon, Ga. Both lines were designed for 1,200-psi. operation and have crossover connections with a lower-pressure system at several points along the line.

After a short period of operation, it was found that the line efficiency had dropped approximately 15 per cent and that considerable amounts of distillate were being collected by inlet scrubbers at the two compressor stations along the line. Large quantities of distillate were also being collected at crossover points when gas deliveries were being made through regulators into the lower-pressure system. Drips had been installed on both the 18-in. and 16-in. pipe lines but which collected very little distillate with the drips closest to the inlet to the line collecting none at all.

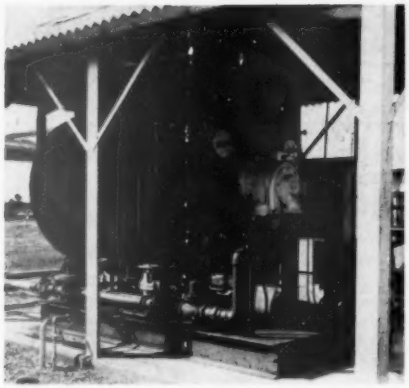
*Chief engineer and †engineer, Southern Natural Gas Co., Birmingham, Ala.



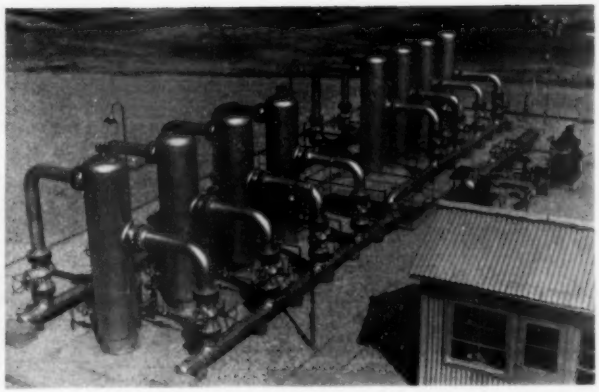
UNUSUAL FEATURE is that there is no wet gas-lean oil absorption tower. Rather lean oil is picked up from these tanks by pump in foreground and jetted directly into wet-gas gathering lines where distillate absorption takes place.



ABSORPTION OIL IS METERED through the orifice flange equipment shown here. Each of the four parallel lines is carrying a semirich oil to venturi-type injection nozzles.



STRIPPING STEAM to rich-oil still is generated in this package unit, with a capacity up to 3,450 lb. of steam per hour.



THESE EIGHT SCRUBBERS were the initial nucleus of the present Gwinville distillate-removal plant. Their present function in operation is shown in the accompanying flow diagram.

This indicated that the gas was undergoing retrograde condensation as the pressure and temperature were reduced due to flow in the line and deliveries through regulators into the lower-pressure systems. Subsequent tests proved this was the case and showed that maximum dropout occurred at lower temperatures and at pressures between 200 and 400 psia. as shown by the curves on Fig. 1.

Thus the retrograde condition of the gas eliminated the possibility of using drips to eliminate the liquid problem and although the compressor inlet scrubbers removed considerable amounts of distillate, they were not adequate to dry up the line. Consequently, the necessity of a hydrocarbon control or distillate reduction plant was dictated.

Distillate removal plant . . . For this purpose it was decided to build a plant at minimum cost and which would be designed to process a maximum of 365 M.M.c.f. per day. The plant was designed and constructed by Ford, Bacon & Davis Construction Corp. with the help of Southern Natural Gas Co.'s engineers. The primary purpose of the design was to eliminate distillate condensation in the transmission system and although the plant has only been in operation several months, it has proved that it will accomplish the purpose for which it was intended. In addition to eliminating the distillate dropout in the lines, it is estimated that the distillate recovery will take care of all operating expenses and show a small margin of profit on the investment.

An unusual feature of the distillate reduction operation is the injection of absorption oil in the field lines as a means of avoiding the expense of normal absorption equipment.

Plant Design and Operation

The distillate removal problem facing Southern at Gwinville had several aspects:

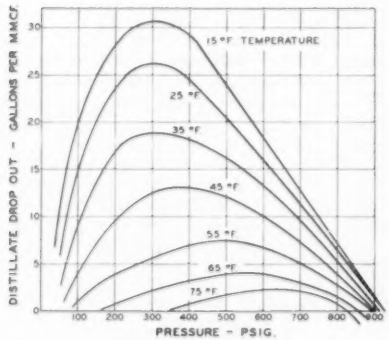
1. In operating its 18 and 16-in. south main line from Gwinville, Miss., to Montgomery, Ala., and Macon, Ga., there was an estimated 15 per cent loss in line flow efficiency due to dropping out of liquid distillate as a result of retrograde condensation when pressures and temperatures were reduced either through flow or through regulators.

2. Distillate carryover was not of mechanical nature and could not be eliminated by separators placed along the line. Processing the gas for distillate removal at Gwinville was the only method for improving line capacity by eliminating the distillate.

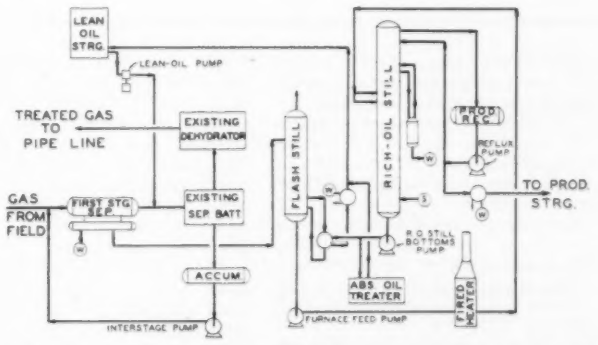
3. The use of conventional absorbers was considered but due to various economic factors and the delay in obtaining delivery, it was decided that an injection system would be employed.

Plant completed . . . A simple oil-absorption plant was completed early this year, employing a lean-oil circulation of 500 gal. per million cubic feet applied by injection of "semirich" oil

(Continued on page 114)



DISTILLATE DROP-OUT characteristics of Gwinville field gas. (Fig. 1).



BASIC ARRANGEMENT at Southern Natural's Gwinville distillate removal plant and the major items of equipment in use. (Fig. 2).

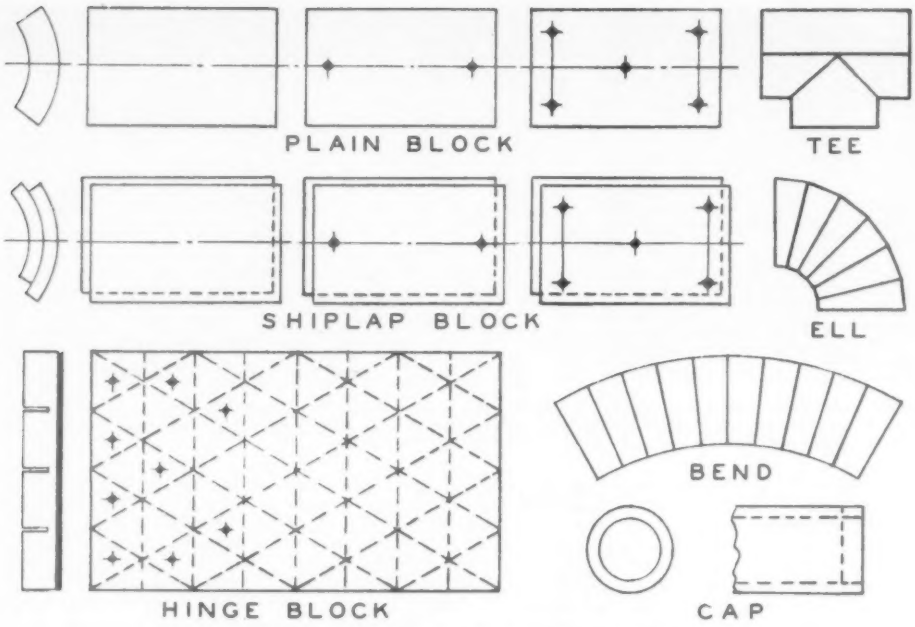


Fig. 1—Some of the shapes used in the new insulation method.

NEW PROCEDURES IN . . .

Industrial Thermal-Insulation Application

Thermal insulation is required in many refinery applications, where temperatures vary from the very low values used for refrigeration processes to the very high ones encountered in furnace operation.

These two articles, one on high-temperature insulation and the other on low-temperature insulation, bring together a number of pertinent facts on this important subject. New methods, materials, and concepts are highlighted.

**by C. J. Kuhasz*
and E. C. Shuman†**

METHODS have been developed which drastically reduce the installed cost of thermal insulation.

These include not only new application techniques, but also the development of prefabricated shapes which reduce cutting and forming in the field to a minimum. Advantages are (1) greater economy, (2) a saving in the amount of critical material required, (3) greater durability, and (4) elimination of the confusion resulting from the use of various grades and thicknesses of material.

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These methods have been employed on three projects now in operation, with savings of $50,000 to $250,000, and on numerous others currently under construction. Savings run from 15 to 25 per cent of the cost based on previously used processes.

Reduction in number of insulating joints varies from 200 to 700 per cent, while reduction in the number of separate operations required for an installation runs from 30 to 60 per cent of those formerly required.

Former difficulties . . . Difficulties of older methods are concerned with the weathercoating, and are (a), failure of weathercoating at the joints between blocks under extreme elevated temperature service due to heat infiltration, (b), failure of bond between the insulation and weathercoating due in part to materials and in part to moisture saturation of the insulation by rain, and (c), failure of weathercoating due to insufficient weathering and heat resistance.

To avoid such difficulties and to make the method as nearly foolproof as possible the following steps were taken:

(a) The design of joints for high temperature service was modified to insure that the weathercoating reinforcement would not be strained excessively as a result of expansion of the metal to which the insulation is applied. (b) The holes for the attachments were counter bored and packed to eliminate any possibility of over heating the coat by conduction through the pins. (c) All insulation was prime coated on the outside before installing against metal surfaces, in order to minimize water absorption from unexpected rains which may occur before the weathercoat is applied on the job.

General Description of Method . . .

Using this method of installing thermal insulation it is possible to apply insulation to the metal surfaces of vessels, equipment, piping, valves, fittings, bins, duct work, etc., at reduced installed costs that are well below those of other methods, even though initial material costs are slightly higher.

Insulating material . . . The method can be employed for all operating metal temperatures up to 1,200° F. while specifying one type of rigid insulation material known as hydrous calcium silicate in a single thickness. The density of this material is approximately 11 lb. per cubic foot and its average compressive strength about 150 lb. per square inch. The material is insoluble in water, has a high wet strength, is incombustible and its handleability is exceptionally good, resulting in a very small amount of waste. The material is supplied in 1 to 5-in. thickness in increments of ½ in., in the forms of flat and curved block and pipe insulation.

Shop Fabricated Shapes

The bulk of the insulation material is shop fabricated in standard shapes and properly identified for field assembly. The size of each piece is predetermined for ease of manhandling and minimum damage during shipment and erection. In general, the length of each piece is 36 in. and the thickness is either cast or laminated up to 5 in.

For cylindrical surfaces of vessels, pipe, etc., the width of the curved blocks and the number of pieces around each circumference are determined by the diameter. In general, pipe insulation is supplied in two pieces for diameters from ¼ to 12 in., three pieces for 13 to 18 in., four to eight pieces for 19 to 40 in., and in nominally 18-in. wide pieces for diameters over 40 in. up to 60 ft.

For irregular curved surfaces, such as heads, cones, transitions, etc., blocks of two types are supplied: (a), 18 by 33-in. hinged blocks made by adhering woven glass fabric to individual small blocks of triangular shape (the glass fabric provides hinging action and there is little danger of the pieces breaking apart), (b), 9 by 18-in. curved blocks with the direction of curvature determined for best fit of surface covered. A change in radius is dictated when the space between the inside of the insulation and the metal surface exceeds ⅛ in. For flat surfaces such as bins, ducts, etc., flat blocks are supplied in widths up to 18 in.

For pipe fittings, valves, flanges, etc., of the butt weld type for diameters larger than 2½ in. and for flanged types larger than 1½ in., standard pipe insulation is cut, formed and securely held together with a water and heat resisting cement and is supplied preassembled weathercoated in two to four pieces. Pipe bends from 3 to 10 in. are also supplied from standard pipe insulation.

Insulation used on metal surfaces operating at temperatures below 700° F. have shapes provided with straight-edges cut normal to the outside surface of the piece. For metal surfaces above temperatures of 700° F. the shapes are provided with ½-in. shiplapped edges also cut normal to the outside surface. In addition all pieces for thicknesses of 2½ in. and over are provided with a 30° bevel cut about ⅜ in. deep along all the outside edges.

Insulation used on cylindrical, flat and irregular metal surfaces (except for cylindrical surfaces smaller than 24 in. in diameter operating below temperatures of 700° F.) the shapes are provided with two to five shoulder holes properly spaced, except for hinged block in which a multiplicity of holes are provided. For pieces 2 in. in thickness and below, the shoulder of the hole is 1 in. high and for 2½ in. and thicker is 1½ in. high. For cylindrical surfaces 24 in. and smaller operating at temperatures above 700° F. each shape is provided with two shoulder holes. As an alternate type, straight holes may be used for thicknesses of 2 in. and smaller. In all cases holes are drilled normal to the outside surface of the piece.

The small diameter of the shoulder hole is made large enough to admit a ceramic ferrule for a 3/16 or ¼-in. diameter welding stud, with sufficient clearance to allow proper venting of gases during welding and to prevent scraping the sides of the hole and picking up particles of insulation. The larger diameter is made large enough to admit a welding stud bending or speed clip fastening tool. When the alternate straight hole is used its diameter should be the same as the small diameter hole of the shoulder hole.

Regardless of operating temperatures and kind of metal surfaces insulated, the pieces are protected from moisture. This is done by either prime coating or weathercoating the outside surface of each piece prior to its erection. In general, insulation for cylindrical surfaces smaller than 24 in. in diameter and all pipe fittings, valves, flanges and pipe bends are furnished with a prime spray coat and a 1/16-in thick finished weathercoating applied before shipping. All other pieces are furnished with a film of spray coated water repellent primer applied to the outside surface and the ends, also prior to erection.

When the outside diameter of insulation is greater than 16 in. it is reinforced with a layer of glass fabric when used for pipe fittings, valves, flanges and specialties.

Some of the shapes used in the method described have been shown on Fig. 1.

Field fabricated shapes . . . For pipe fittings, etc., of the butt weld type under 3 in. in diameter, flanged type under 2 in. and for screwed type over 3½ in., standard pipe insulation is supplied for field fabrication.

In addition to the foregoing, on every installation certain items must be considered as specialties and do not fall into the present range of standard shapes. In such cases the economics of shop against field fabrication must be taken into account. A limitation against shop fabrication usually is due to damage of large assemblies in transit; in many cases, though, this can be overcome by increasing the number of pieces and shipping them disassembled. On the other hand, if field fabrication is decided upon it will be noted that most specialties can be made from standard pipe or flat insulation materials.

Mineral wool . . . Prefabricated mineral wool is available for pipe fittings, valves, etc., of the screwed type under 4 in. in diameter.

Felted mineral wool blanket in 1-in. thick layers are supplied for pipe bends under 3 in. in diameter, and for packing construction cracks and openings.

Reinforcement . . . Glass fabric is supplied for reinforcing and should be made in an evenly woven mesh, impregnated with a water resistant compound that is not soluble in the solvent in the weathercoating, in order to prevent possible damage to the glass fibres, which might occur if their coating is partially removed and friction between strands can be induced. The trend count should be no less than 20 per inch in both directions with a minimum strength of at least 60 lb. per inch of width and should weigh about 2½ oz. per square yard.

Fasteners . . . Welding studs are supplied in carbon or alloy steels in either the 3/16-in. diameter split pipe type or the ¼-in. diameter solid pin flux or slug loaded type with a 1-in. diameter metal speed clip, both types are furnished in lengths of 1½ and 2 in. with ceremic ferrules for good welding. Welding studs must be suitable for use with a welding gun of the timed volt-ampere type.

Weatherproofing . . . Prime coat materials which do not introduce water into the insulation and are suitable for spray application are used to prevent rain from being absorbed through the surface of the insulation. In order to obtain a good bond for the weathercoat, the primer should penetrate the surface of the block and not be soluble in the solvent of the weathercoat.

Weathercoat materials suitable for indoor or outdoor spray application are used, such as asphaltic, bituminous and rubber based. The type selected should be based upon the temperature conditions to which the weathercoating will be subjected to, such as heat transfer, magnitude of joint movement and number of times the joint opens and closes in a given period. They should be moderately fast drying, flexible and resilient over a wide range of temperatures with a working temperature of at least 300° F., have good adhesion and good weathering properties and long life.

Coatings should not support combustion to an extent that they will spread fires that reach them. It must be recognized that many solvents are flammable, so that care is essential during application and for a short time thereafter. No serious problem has arisen from this condition in the field.

Cement . . . High temperature plastic cement materials suitable for temperatures up to at least 1,200° F. are used to prevent rain from being absorbed by the insulation in places where the use of weathercoat is prohibited because of excessive metal temperatures. This high temperature cement should be fast setting, have good weathering properties, low water absorption, good adhesion to insulation and metal, high coefficient of expansion to minimize checking and cracking, and when applied should be of troweling consistency.

Other commonly used materials such as metal wire, bands, cables, wire mesh, lacing wire, nails, sheet metal, plastic cements, etc., will not be described herein.

Installing Insulation

To obtain the best results during the service life of the insulation it is very important to adhere to the procedure described for applying the materials to cylindrical, flat and irregular curved metal surfaces.

In order to avoid entrance of water into the insulation, whenever practical, erection of the insulation should be started at the top most part of the metal surface. Around all irregularities projecting from the metal surfaces, pieces of insulation should be cut to fit neatly.

All pieces are installed in such a manner that the flow of heat by convection is minimized along the joints between adjacent blocks. For vessels, equipment, etc., set in a vertical position the longitudinal joints should be staggered and the circumferential or transverse joints should be continuous. In the horizontal position the longitudinal joints should be continuous and the circumferential or transverse joints should be staggered. In all cases the joints between adjacent blocks are butted together tightly.

Cutting reduced . . . To reduce unnecessary cutting and the number of joints, a survey should be made of the metal surface to be insulated, and the first row of pieces to be installed should be started with a longitudinal joint in line with the greatest number of projections which are on more or less a common centerline.

Where shiplapped pieces are used for irregular curved surfaces, it will be found that some of the shop fabricated material will not always fit the curvature and it is necessary to do some lapping in the field. In such cases a mechanically operated tool has been used to cut the lap.

Where hinged blocks are used, they should be cut and fit to conform as nearly as possible to the contour of the metal surface, and protruding edges should be pounded with a wooden mallet to form a reasonably smooth surface.

Insulation should extend beyond the straight portion of cylindrical metal surface a sufficient amount to allow good trimming to conform to the insulation of heads, cones, transitions, etc. The void occurring at the junction of the shell and head insulation should be filled with waste block whenever additional stiffness is required.

The object of individually supporting each piece of insulation is to control and localize to small increments the movement caused by expanding hot metal surfaces. The effect is to distribute the total metal expansion to a great number of positive joints between adjacent blocks. For example, a hot metal surface with a circumference of 95 ft. 0 in., expands 4 in. to 95 ft. 4 in.; using 18-in. wide blocks, the joint between adjacent blocks opens up to 1/16 in. due to the expanding metal surface. Without individual support, it is conceivable for the insulation at some place to open as much as 4 in.

Fastening insulation . . . In general, all pieces of insulation are firmly secured to the metal surfaces with carbon or alloy steel welding studs, either of the split pin type embedded into the insulation, where the metal surface is comparatively clean, or the solid pin flux loaded type with a speed clip, where the metal surface is heavily mill scaled, rusted or painted. When the metal thickness is within the sheet metal range the use of welding studs may be prohibited, in order not to burn through the metal.

In most cases, each piece of insulation is manually held in place while at least two welding studs are fastened to the metal surface. This procedure may be continued for a number of

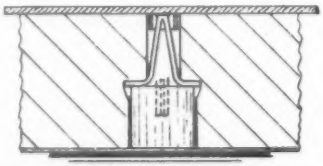

Fig. 2—Installation of split-pin type of welding stud.

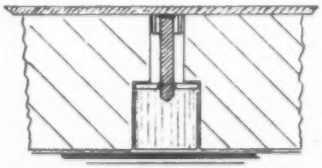

Fig. 3—Installation of solid-pin flux type of welding stud.

blocks or all welding studs can be fastened in each block before proceeding to the next block. The proper number of welding studs used to secure each block will depend on the position of the piece, such as overhead, vertical, etc.

To install the split pin type welding stud, the pin with a ceramic ferrule is inserted into the shoulder hole and welded to the metal surface, after which the ends of the pin are bent over and embedded into the insulation by using a special tool designed for this purpose. Refer to Fig. 2.

To install the solid pin flux or slug loaded type welding stud, the pin with a ceramic ferrule is inserted into the shoulder hole and welded to the metal surface, after which the speed clip is placed on a magnetized tool inserted in the hole and pressed over the pin until it bears firmly against the shoulder. Refer to Fig. 3.

Packing holes . . . In general, after blocks are securely held against the metal surface, either a calcium silicate dowel or mineral wool is inserted into the hole. Where thickness of insulation is under 2½ in., packing may be omitted without any detrimental effects. It is to be noted that only two lengths of welding studs are required regardless of the insulation thickness, one length for 2 in. and less, and one length for 2½ in. or over.

The object of using the packed shoulder hole is to prevent the transfer of heat from the hot metal surface through the welding stud to the weathercoating, thereby maintaining approximately the same temperature at the stud location as is over the entire area of the blocks.

Applying Reinforced Weatherproofing

Insulation and spray applied weathercoating reinforced with glass fabric is comparatively simple to install when compared with conventional methods of using metal wire mesh and multilayer troweled on water bearing plastic cement and weathercoat, or sheet metal covering. It is to be pointed out that one of the most troublesome features and costly items of the conventional methods was the great amount of water bearing plastic cements, which the method described has eliminated.

In general, after blocks have been secured to the metal surface and all cracks and openings larger than ⅛ in. in width have been packed with mineral wool (normal joints between adjacent pieces of insulation will be sufficiently tight to require no packing), the reinforcing and weathercoating proceeds as soon as practical without interfering with mechanics.

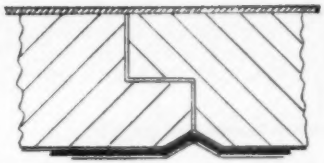

Fig. 4—Reinforcing weathercoating at insulation joints for thick insulation.

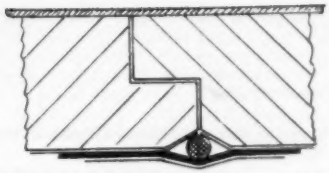

Fig. 5—Installation of insulation on high-temperature metallic surfaces.

It should be noted that when at any time the insulation cannot be completely covered with glass fabric, due to conditions in the field, the tack spray coat must be continued until it covers all the exposed surfaces of the insulation before leaving that area of work. The finish weathercoating should be sprayed over the glass fabric to a thickness which will dry to approximately 1/16 in.

Where metal temperatures are above 300° F. the weathercoating should not come in contact with the metal surfaces, at such places a high temperature cement should be used. Preferably the finish coat should be applied as soon as practical, so that scaffolding can be removed and waste cleaned up as the work progresses. With respect to patent scaffolding it can be reused more often than heretofore and a smaller initial amount is required when compared with installing insulation by conventional methods.

Glass fabric reinforcing should be cut into strips about 7 ft. long, and when installing, it should be lapped along all edges at least 3 in. Prior to installing glass fabric it is important to see that the tack spray coat is wet, because if it is not there will be no adhesion between the block and the glass fabric. When embedded into the tack coat the glass fabric should not be pulled tight or stretched, rather, it should be layed on the tack coat and pressed into it just free of wrinkles. In fact, some small wrinkling will be helpful as it will show some slippage of the individual glass fibers within the weathercoating.

The finish weathercoating must be uniformly sprayed to a thickness of 1/16 in. over the entire area of the glass fabric in order to protect the fabric against deterioration.

Sealing Joints Between Blocks

Reinforcing weathercoating for insulation 2½ in. in thickness and over should be applied to the joints between adjacent blocks, in the same way and, at the same time as the block surfaces. The glass fabric should be pressed into the tack coat and formed to the contour of the notch and covered with weathercoating. Refer to Fig. 4.

This type of joint allows the hot metal surface to which the blocks are rigidly fastened to move without putting tension on the weathercoating, thereby keeping it free from cracks. The joint functions as follows: during the first heat up of the metal surface and as the metal expands the reinforced weathercoating starts to peel back from the apex of the notch, the peeling action continues until the maximum expansion of the metal surface is reached.

Upon cooling of the metal surface the weathercoating recedes into the notch. The only stress to which the weathercoat is subjected to is flexing action caused by subsequent cycles of heating and cooling.

For extremely high temperature metallic surfaces a joint similar to the preceding one is used, except a heat retardant seal of soft asbestos rope or its equal is inserted in the notch over the joint between the blocks prior to installing reinforced weathercoating. Refer to Fig. 5.

This type of joint is similar to that described above, except a heat retardant seal is furnished to reduce the transfer of heat by convection from the metal surface to the weathercoating, thereby keeping it free from cracks and embrittlement; furthermore, the seal will prevent charring of the weathercoating.

Miscellaneous applications . . . Although the greater part of every project requiring insulation consists of covering plain metal surfaces, there are many places on vessels, equipment, etc., where special considerations must be employed to provide a satisfactory installation. Several of the most important are described herewith.

Weld seam lanes . . . When weld seams in metal surfaces require periodic inspection, the seams are covered with 6-in. wide single or 9-in. wide shiplapped curved or flat blocks. In general, the metal surfaces to within 3 in. of either side of the weld seam are insulated and weathercoated first, form-

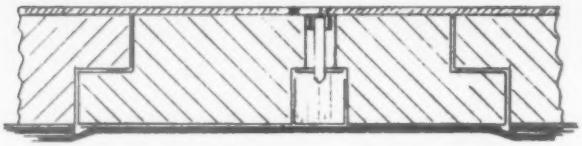

Fig. 6—Installation of insulation for weld seams.

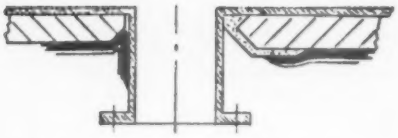

Fig. 7—Insulation of projections, which are cold metal surfaces.

Fig. 8—Insulation of projections which are hot metal surfaces.

ing a lane, after which the lane blocks are placed in the lane and secured with welding studs. Reinforced weathercoating is then installed and lapped at least 3 in. over the permanent insulation. When it is necessary to remove lane blocks, the weathercoating is cut along the edges of the lane, welding studs opened, and lane blocks lifted from place. To replace, the same procedure for installing is used. Refer to Fig. 6.

Projections Through Insulation

Where metal surfaces project through the insulation, such as nozzles, etc., which are below 300° F. The edges of the block adjacent to the projection should be beveled at an angle of 45° 1 in. deep on the inside. The blocks should be installed by extending them to within ¼ in. of the projection and firmly secured, after which the bevel and adjacent block, and 4 in. of the projections surface should be sealed with two layers of reinforced weathercoating. When glass fabric is installed it should be pressed into the contour of the bevel and overlap the glass fabric on the block by at least 2 in. Refer to Fig. 7.

Where hot metal surfaces project through the insulation, which are above 300° F., The edges of the block adjacent to the projection should be beveled at an angle of 45° 1 in. deep on the inside and 45° on the outside. The blocks should be installed by extending them to within 1 in. of the projection and firmly secured, after which the space between the projection and the block should be sealed by troweling it full of high temperature cement, which should be extended along the surface of the block for at least 4 in.

Water should be kept off the cement for several hours to allow setting. After the cement has dried a 4 in. wide strip of reinforced weathercoating should be placed over the joint between the block weathercoating and the cement. Refer to Fig. 8.

These seals are to prevent water from getting into the insulation and behind the weathercoating and, to decrease the transfer of excessive heat to the weathercoating, thereby, overcoming cracking, peeling, embrittling, loss of resiliency and general deterioration of the weathercoating.

Insulation flashing . . . The top head of vertical vessels should be provided with a rain drip properly flashed to the insulation. Refer to Fig. 9. The seal should be made by installing two layers of glass fabric on the vertical blocks and then extending it over the knuckle curvature by at least 12 in. A rain drip made of galvanized sheet metal at least 6 in. wide should then be installed around the curvature by nailing it into the insulation. The edge of the drip should extend about ¾ in. beyond the vertical blocks. The drip should be covered with a layer of weathercoating, extending over the head insulation.

The heads of horizontal vessels should be finished as described above, except the rain drip is omitted.

Where insulation terminates on the metal surface for temperatures above 300° F. the ends of the blocks are flashed against the metal surface. Refer to Fig. 10. The seal is made by beveling the ends of the block at 45° in direction of drainage, after which a piece of galvanized sheet metal flashing is extended along the metal surface about 4 in. and along the surface of the block for 4 in. The flashing should be fastened to the metal surface with a continuous metallic bead. Before flashing is installed the blocks should be weathercoated to within 2 in. of the bevel so that flashing can be extended over it.

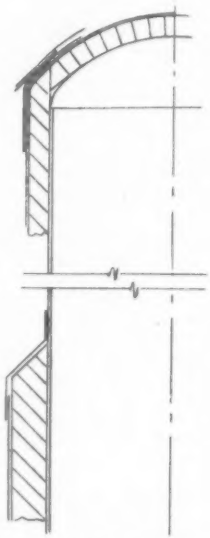

Fig. 9—(Top) Rain drip should be provided for top head of vertical vessels.

Fig. 10—(Bottom) Termination of insulation on metal surfaces above 300° F.

Where insulation terminates on metal surfaces for temperature below 300° F., the ends of the blocks are flashed against the metal surface as described above, except reinforced weathercoating is substituted for the sheet metal.

These seals are to prevent water from entering joints between insulating blocks or between blocks and metal surfaces, thereby keeping insulation dry, which in turn reduces corrosion effects on the metal surfaces covered.

Straight and Bent Pipe Application

In general, shop weathercoated insulation should be installed on straight pipe of 22 in. in diameter and smaller and on pipe bends from 3 to 10 in. in diameter. Depending upon metal surface temperatures, either weathercoated hinge block or 9 in. wide shiplapped curved pieces should be installed on pipe bends larger than 10 in. and on irregular metal surfaces. For pipe bends under 3 in. in diameter, felted mineral wool blanket in 1-in. thick layers should be installed. It should be noted that shop weathercoated pieces are optional for indoor application.

Whenever practicable, insulation for butt weld fittings, valves and pipe bends should be installed prior to the pipe insulation. Where flanged type fittings and valves are to be insulated, the pipe insulation should be insulated first in order to allow fitting and valve insulation to extend over the pipe insulation.

Installed loose . . . Insulation should be installed with recognition of the desirability of a specified degree of fit, and adjusted to be moderately loose for the temperatures expected. When installing the pieces, full circumferential

joints are used between adjacent pieces of shop weathercoated insulation and where practicable all longitudinal joints should be placed on, or as near as possible to the horizontal center line of the pipe. Where prime coated pieces of insulation are installed the vertical joints should be staggered and horizontal joints made continuous. In all cases joints between adjacent pieces of insulation must be tightly butted together.

Wherever shop weathercoated insulation is used, the pieces should be secured to the metal pipe surfaces with wire loops that have the ends twisted and embedded in the insulation, or steel bands. The type of securement and the number used for each 36-in.-long piece will depend on the diameter of the pipe.

Packed openings . . . Openings larger than ⅛ in. in all insulation should be packed with mineral wool. Normal joints between adjacent pieces of insulation will be sufficiently tight to require no packing.

After shop weathercoated insulation has progressed along the pipe sufficiently not to interfere with mechanics installing it, the longitudinal and circumferential joints between adjacent pieces of insulation should be weathercoated, so that no moisture can enter the insulation. Weathercoating is either applied by brushing, troweling or smearing on with a glove to a smooth finish.

All exposed surfaces such as ends and edges should also be weathercoated. Prior to sealing circumferential joints they should be reinforced with a band of glass fabric at least 3 in. wide embedded in the weathercoating. Where beveled edge is used the glass fabric should be pressed into the joint; where straight edge is used the fabric should be relatively loose to permit some movement when the pipe expands.

Where projections extend through the insulation, the joint should be sealed in the same manner as described for vessels, etc.

Where prime coated insulation is installed, the application procedure should be the same as described for vessels, etc.

Pipe Fittings, Valves Flanges

In general, shop fabricated weathercoated insulation covers should be installed on pipe fittings, valves, flanges, etc., from 3 to 24 in. in diameter. For diameters under 3 in. either standard pipe insulation or mineral wool as described herein should be installed. It should be noted that when the diameter of the insulation used is greater than 16 in. the fittings, etc., are reinforced with glass fabric. Shop weathercoated pieces are optional for indoor application.

Whenever practicable, insulation for buttweld type elbows, tees, valves, etc., should be installed prior to the pipe insulation; butt weld caps and reducers are considered part of the pipe insulation. Where flanged or screwed type fittings and valves are to be insulated such as flanged joints, elbows, tees, valves, couplings, etc., the pipe insulation is installed first.

When butt weld fitting insulation cannot be installed as mentioned, the location of the extremities of the fitting should be marked on the metal surface of the pipe, so that when fitting insulation is installed it can be butted tightly against the pipe insulation without cutting it.

Parallel to pipe . . . All fitting insulation should be installed with the center lines parallel and normal to the pipe insulation of which they are a part. All joints in the fitting insulation, and where it comes in contact with pipe insulation should be butted tightly together.

Where fitting insulation overlaps pipe insulation, such as in the case of flanged type, the space between the outside of the pipe insulation and the inside of the fitting insulation should be packed with scrap insulation or mineral wool. In many cases, because of the nesting arrangement of the insulation sizes, the need for packing is eliminated.

In places where it is possible to damage fitting insulation after it has been installed or where additional rigidity is required because of external weights resting on the fitting, such as flange type, the void between the metal pipe fitting and the inside of the insulation should be reinforced with filler pieces made from scrap insulation. Places like these are the only ones where this should be done; all other voids are to remain unfilled.

Openings larger than ⅛ in. in all insulation should be packed with mineral wool. A typical case is the space left after cutting valve insulation for bonnet flanges of a globe valve.

Shop weathercoated fitting insulation should be secured to the metal pipe fitting with wire loops that have the ends twisted and embedded in the insulation, or with steel bands. The type of securements and the number used will depend on the size and the number of pieces installed. Flanged fitting insulation should be secured where it overlaps the pipe insulation.

Joints in fitting insulation should be weathercoated, reinforced and sealed as the work progresses against moisture as described for shop weathercoated pipe insulation. In addition all exposed ends, edges, etc., should be completely sealed with weathercoating. Furthermore, all joints between fitting insulation and pipe insulation should be reinforced with glass fabric.

When fitting insulation is made in the field, either of shop weathercoated insulation or mineral wool the individual pieces of insulation should be secured with wire loops, reinforced with a layer of glass fabric and finally given a finish coat of weatherproofing.

Where it is necessary to insulate fittings larger than 24 in. in diameter, prime coated curved pieces are used. The individual pieces should be either secured with wire loops or steel cables after which the insulation should be given a first spray coat of weatherproofing into which is embedded a layer of glass fabric properly lapped and finally a finish spray coat of weatherproofing.

Insulation for steam tracing . . . In some cases, the outside metal surfaces of equipment, pipe and fittings are provided with tubing, through which steam flows for the purpose of furnishing additional heat, or for stabilizing the chemical process, usually referred to as steam tracing.

In such cases, the insulation size used on equipment and piping, includes the steam tracer tube, so that when the insulation is installed it is placed against the tubing. When fittings are steam traced the size of the insulation is not increased to include the tubing, instead, at points of interference the insulation is gouged out to accommodate the steam tracer tube. In order to reduce the amount of gouging the tubing should be located on the metal surface where the joint in fitting insulation will occur. The insulation procedure for installing, packing, securing, reinforcing, and weathercoating is the same as described herein. Where welding studs are used to secure insulation, care must be taken to avoid welding to the steam tracer tubing.

Insulation for Turbines, Pumps

Where hinged block can be used conveniently against irregular metal surfaces, they are installed, packed, secured, reinforced and weatherproofed as described herein.

When hinged block cannot be used conveniently, plastic cements are applied to the irregular metal surfaces in 1½-in. thick layers, with each layer reinforced with 1-in. hexagonal galvanized poultry mesh, as used conven-

tionally. However, after the hard coat of plastic cement has been applied and completely dry, the entire surface of the insulation is given a first spray coat of weathercoating, into which is embedded a layer of glass fabric properly lapped, and finished with a 1/16-in. thickness of weathercoating.

Weathercoating should not be applied by the spray method where overspray will require too much cleaning up; in such cases it should be applied by either brushing, troweling or smearing on with a glove, to a smooth finished surface.

It should also be recognized that by using the methods described herein more engineering of insulation is required than heretofore. However, this added cost is more than offset by the fact that all parts of the installation are not only properly insulated with the correct material, but when the work is finished there will be no disagreements as to the amounts of insulation used for equipment, piping, fitting, etc., between purchase and applicators. On many installations in the past this was not so and necessitated the employment of measuring teams. It is to be noted that when the methods described are specified the applicator can quote on the insulation work, without any doubt as to the correctness of the amount of material and the labor involved; on the other hand, the purchaser knows what he is getting when the work is completed.

Advantages of Method . . .

A. Cost Benefits

The writers have found the following major cost factors to be noteworthy. It is recognized that all factors are not of the same importance on all installations and therefore no importance is attached to the order in this list.

Much less basic material need be requisitioned. Instead of about 10 per cent excess for contingencies, only 1½ to 3 per cent need be requisitioned, depending on quantities and types of materials involved.

Auxiliary materials, such as structural steel shelf angles, channels, plates, etc., welded to hot metal surfaces solely for supporting and attaching of insulation are entirely eliminated when split pin or solid type welding studs are utilized. Small pieces of steel attached at specified locations on equipment, etc., are costly and at present critical.

In general costly materials needed to protect insulation against weather during erection are practically eliminated, and only comfort of workers need be considered. It is to be noted that with the methods described, insulation can be applied in subzero climates with little danger of freezing; in the past this was a very costly item to control.

Rain resisting . . . The material, hydrous calcium silicate, resists rain. If applied insulation becomes saturated before weathercoating, or before application, it is not damaged except by freezing; drying before coating is all that is required, but this is essential to prevent trapping moisture in the insulation. It is to minimize the danger of this occurring that the insulation is prime coated in the shop. Insulation saturated after application does not fall off.

In general, no heat need be provided to dry out wet insulation. The elimination of water-mixed plastic cements makes it no longer necessary to employ costly heating equipment and waiting time, previously required to dry or thaw out insulation. The only time such equipment is needed is when the weatherproofing is not applied as outlined herein or when plastic cement is used for irregular surfaces.

Corrosion minimized . . . Because these methods produce weather protected insulation of a high degree of moisture resistance, and because practically no water-mixed materials are used, corrosion will be minimized on all metal surfaces covered. Furthermore, hydrous calcium silicate is alkaline and therefore rust inhibitive.

Insulation work may be started wherever convenient; however, it is best and more economical to start installing insulation at the topmost surface and progressively weatherproof downward so that rain, even though unexpected, will not wet the insulation and run behind it, and further accelerate corrosion of the metal surfaces. It should be noted that wetting the insulation is also of concern to the extent that moisture must be removed before the insulation is completely weatherproofed, to avoid building up vapor pressure and decreasing thermal efficiency of the insulation until it becomes dry.

Errors reduced . . . Because only one kind of basic insulation material of a single thickness is used for the full range of temperatures up to 1,200° F., it will be found that errors in applying the improper insulation is greatly reduced, compared with projects of which several materials are specified. The amount of handling of individual pieces and the accompanying breakage also are decreased. Furthermore, handleability of hydrous calcium silicate, particularly where small cutouts are needed, simplifies application.

An appreciably smaller number of field operations are required; in most cases about half as many when other methods of application are considered.

The larger pieces of insulation now made available through this procedure, nominally 18 by 36 in., reduces the number of joints to seal, pieces to handle and the amount of breakage.

Simplified operation . . . Either single or shiplapped pieces are installed and secured to the metal surfaces by the same procedure; this greatly reduces and simplifies the number of field operations when multiple layer insulation is applied. Furthermore, the use of shiplapped pieces has eliminated continuous full depth joints between the outside of the insulation and the metal surface to the vanishing point. It is significant to note that continuous full depth joints have been observed, even in some cases where multiple layers of 4 or 6-in. wide pieces of insulation have been used.

Individual mounting of the pieces makes it comparatively easy to support the insulation at places where large openings occur in the metal surfaces and where small and large pieces of equipment are fastened to the metal surfaces such as metal reinforcing pads, manholes, nozzles, etc. Furthermore, all metal rings used for fastening insulation cables and bands at these points have been eliminated.

The use of hinged block which are normally 4.5 sq. ft., simplified installing the insulation on double curved metal surfaces by eliminating the usual 4 or 6-in. wide field scored blocks equivalent to 1.0 or 1.5 sq. ft. respectively, and through the elimination of successively applied water bearing plastic cements.

Waste reduced . . . Running the cylindrical, longitudinal or vertical insulation beyond the junction of double curved surfaces, firmly supports the insulation on the double curve and simplifies installing it whenever short radii occur. The use of filler blocks made from scrap insulation, which is always available, not only provides the necessary support where needed but helps to dispose of waste insulation material and reduce the amount of cleaning up when the work is completed.

Reinforcing the outside surface of the insulation with glass fabric simpli-

fies the application while at the same time providing an inert material not subjected to deterioration from corrosion or other deleterious effects. It is essential that material conforming to the specifications set forth herein be employed, since the use of inferior material will not produce a satisfactory job.

Installing an extra layer of glass fabric and a metal rain drip at and along the juncture of head and cylindrical insulation on vertical vessels will prevent potential cracking of the weatherproofing at this point, and make it possible to stop water from getting behind the insulation. Furthermore, rain water as it runs down the head is diverted from against the sides of the insulation by the rain drip.

Better fit . . . Furnishing curved segments of insulation of different radii for double curved surfaces will allow the insulation to fit better against these surfaces and appreciably decrease the amount of cutting and cracking of the insulation during application.

On metal surfaces, such as are found in rectangular and square bin and duct construction it will be seen that the use of welding studs greatly simplifies securing the insulation at corners, stiffeners, etc.

With individual mounting, any part or piece of insulation can be removed without disturbing the remaining insulation or have it fall off, when it is necessary to make changes to the metal surfaces insulated or to repair the insulation. Removed material when handled with moderate care can be reused.

Each piece of insulation is individually mounted and the relative change in dimensions due to longitudinal and radial thermal expansion of the metal surface and the shrinkage of the insulation need be compensated for at the joints only of the small units, usually 4½ sq. ft.

Operations reduced . . . The strength of the insulation material and the independent support method described for installing, and removing insulation at weld lanes has simplified the application at these places by reducing the number of field operations, and has eliminated the double continuous steel plate border strips, previously tack welded along both sides of the seam. These plates were used to fasten the cables or bands of the permanent insulation and provide a lane for removable insulation over the weld seam.

The use of welding studs for securing insulation to metal surfaces has eliminated all sagging, when insulation is installed in overhead positions or any other position where the dead weight of the insulation rests on the attachment, such as cables, bands, etc.

The subsequent attachment of cables, bands, etc., for securing insulation is eliminated in the case of vessels, equipment, etc., except when alternate method of application is used.

Little job cleaning . . . The strength of the material is such that workmen can walk on it without damaging any materials. While not recommended in general, in cases where necessary, scaffold planks can be placed on the finished insulation without damage. Furthermore, few repairs are needed at the end of the job because both the insulation and the coating resist moderate abuse.

Little expense in job cleanup is involved. A job involving about $100,000 worth of insulation has only enough waste material accumulated to be carried away in a pickup truck.

After completion of the job, since practically all items are listed on a materials order, measuring teams are not needed for quantity surveys, with subsequent negotiations because of disagreements.

In case of fire the mounting of individual pieces prevents the falling off of the insulation as occurs when cables or bands are used.

B. Personnel Considerations

From the standpoint of the workmen, the following factors should be considered.

1. It is felt that as the installed cost of thermal insulation decreases, the amount of insulation to be applied will be increased.

2. Hydrous calcium silicate is pleasant to handle, and permits a better appearing job for the conscientious craftsman.

3. There is inherently less dust than with other softer materials and the basic material is not a hazard.

4. Since the amount of gymnastic work around fittings to be applied from high scaffolds is reduced, so is the accident hazard reduced.

5. Due to hydrous calcium silicate being insoluble in water, it does not produce a slimy surface on planking after rain when partially redried, and thereby reduces the accident hazard.

C. Maintenance

A major problem in thermal insulation in the past has been maintenance which is always necessary because of job accidents which result in damage to either the weathercoating or the insulation or both. It seems obvious that repairs to the coating or the insulation have been simplified with procedures described.

When damage occurs to the weathercoating, it is repaired by brushing on weathercoating or brushing on weathercoating reinforced with glass fabric depending upon the extent of damage.

When damage occurs to the insulation, it is removed and new insulation installed. It should be noted that where the welding stud method of attachment is used, only those pieces damaged need be removed and replaced without disturbing remaining material. If already weathercoated, the coating is cut along joints, and the replacement made and recoating applied, using glass fabric reinforcing where desirable. This partial removal also applies to parts of fittings which are damaged.

In service, it is anticipated that for high temperatures there may be some distress in joints, even though reinforced, after some time of service. If so, maintenance crews can recoat the checked areas easily by brushing on additional coating and reinforcing. It is felt that recurrence after such treatment will occur rarely especially where the bevel type joint is used.

Here is an item on which improvement can be expected when more elastic and durable coatings become available. It is to be noted that conventional coatings used in the past always were a source of a great amount of maintenance due to checking and cracking.

In service, it is also to be noted that due to the toughness of the weathercoating and strength of the insulation material, equipment and piping covered with insulation can readily be used to support scaffold planks with moderate dead loads, without damage.

Specifications, Equipment, and Storage . .

No equipment is required for this method that is not already on the market. The following equipment is used in addition to the usual tools of the trade of insulation applicators:

1. Welding generators, 400 amp., for every two weld guns.

2. Weld gun of the timed-volt-ampere type, equipped with proper chuck and ferrule holder.

3. Spray equipment with necessary compressed air and accessories.

4. Hand electric drill for extra holes for weld-pins. Canvas or rubber gloves for wiping on coating.

As mentioned, code requirements or

design considerations sometimes prohibit any field welding of even light metal, such as welding studs on equipment. In these cases, the present conventional methods of supporting insulation with steel clips, etc., must be provided, and the insulation secured with cables, bands, or wire. Also, provision must be made for expansion joints. However, from this point on, packing, reinforcing and weatherproofing procedures described can be followed. The galvanized sheet metal strip at expansion joints can be installed as noted below.

When the use of welding studs is not prohibited, and it is desired to use cables or bands, the steel supports can still be eliminated by using welding studs on only the bottom row of insulating blocks, where the insulation starts, and immediately above the planned expansion joint. Since this row of blocks is fixed, and the material has sufficient strength to carry the insulation above it to the next expansion joint, shelf angles are not required. The intervening insulation can then be attached by cables or bands.

Again, a sufficiently strong material permits the construction of a simple expansion joint by nailing a 6 to 8-in. wide strip of galvanized sheet metal to the insulation immediately above and over the joint. The glass fabric for the section above the joint is started flush with the lower edge of the sheet metal and carried upward without restraining the possible motion in the joint. It should be noted that the glass fabric and weathercoating is carried up to the top of the insulation just below the joint before attaching the metal strip. This permits vertical motion of the metal strip without exposing any insulation to weather.

If staggered block construction is used, the blocks are installed beyond the planned expansion joint, and each block above the joint attached with welding studs. Then the alternate blocks which span the joint are sawed completely through and the metal strip attached as mentioned.

Requisitioning Insulation Materials

With this system of insulating a more carefully organized material take-off is required. However, with the proper factors and tables the amount of each material can be arrived at readily with little more effort than heretofore.

It should be noted that there is no doubt as to the exact quantities of each material needed when the take-off is completed, because the surface areas, length of pipe insulation and number of fittings have been specified. This more positive estimate of quantities is possible because it is known where each type of insulation begins and ends, which had not been true in the past when builtup fittings overlapped pipe insulation.

Therefore, it is no longer necessary to purchase excess material in large quantities to make certain there is sufficient quantity at the job site for completion. For the application procedure described, no material is ordered in excess of 1½ to 3 per cent above the take-off quantities. On foreign projects, these excess quantities are increased slightly.

Specifications . . . Under this system, the designing engineers indicate sizes and lengths of all units, and the thickness of insulation required. Since the demarcation between single and shiplapped layers is 700° F., expected operating temperatures are indicated merely as above or below this temperature. By limiting the specification to such simple notation, the designing engineers have not placed in the hands of the manufacturer of insulation valuable data on expected operating temperatures which they may wish to keep confidential.

From the writers' experience, this system involves some added engineering time. The insulation manufacturer determines quantities required to insulate irregular shapes since these quantities can best be determined by the manufacturer, who adjusts quantities to the dimensions of the pieces of insulation he makes.

Simplifications . . . In order to simplify taking off and summarizing insulation materials for requisitioning, standard sketches and tables have been developed for use with equipment drawings, insulation design specifications and to-scale single line isometric drawings. The procedure serves as a quick means for determining the shape, securement, reinforcement, weathercoating, and joint requirements for any given piece of equipment and pipe size for any temperature and insulation thickness.

Identification marks for the various insulation shapes are also obtained, partially by codes. It should be noted that this procedure in quantity survey gives the quantities of piping and fittings at the same time that it gives quantities of insulation. Final quantities to be ordered are obtained by multiplying the square feet of areas or the lineal feet of piping by factors. It is emphasized that this includes the quantities of auxiliary materials as well.

Identification System for Insulation Material

Because all materials are "tailor made" pieces, and each piece has a definite place in the over-all erection scheme, the manufacturer marks each piece and the carton in which it is shipped to identify its use. When items are interchangeable for dimensions on several pieces of equipment, for example, all interchangeable identifications are used.

Sample of marking:

"A tower 80 ft. high on the shell and 10 ft. in diameter with 2-in. thick insulation, having ellipsoidal heads, designated E-101, would have each shell insulation piece marked 120 x 2, with the cartons marked 36 sq. ft., 120 x 2 E-101, and each piece of head insulation marked, Hinged Block 2, with cartons marked 36 sq. ft. Hinged Block 2 E-101. For five 6-in. butt-weld elbow insulation, 2 in. thick, shop-coated with weathercoating, each piece would be marked 6 x 2 BWL and cartons marked 5 Butt weld Ell Coated 6 x 2."

Detailing special insulation . . . Because it is impractical at this time to standardize all insulating materials including special shapes or dimensions, it becomes necessary to detail either new pieces of insulation for shop fabrication or to use combinations of standard pieces. The decision must be made on the economics of shop or field fabrication, taking into account the cost of possible added engineering, manufacturing and shipping difficulties and handleability in the field. When the decision is in favor of field manufacture, the proper pieces must be requested for easy assembly, and instruction for erection forwarded to the field.

Storage Arrangement

The storing or warehousing of any kind of material on any size project is always a problem, with its major difficulty the easy withdrawal of specific items. To avoid rehandling of materials in finding specific items, or due to errors in selection, the markings described permit predetermined locations in the storage area to be used immediately upon removal of shipments from railroad car or truck.

More care in locating items upon receipt at the warehouse has been found to save an appreciable time when withdrawals are made. However, the keeping of records of receipts and withdrawings accompanying the actual moving of the materials, enables an accurate running record to be kept available at all times. This is particularly desirable when partial shipments from the manufacturer are being handled.

LOW-TEMPERATURE INSULATION . . .

for refinery service

How to Get Economical Installation

by W. L. Martin*

The high costs associated with both the extraction of heat to secure low temperatures and the application and maintenance of low-temperature insulations dictate the necessity of obtaining the most efficient, dependable, and economical insulation for each particular low-temperature operation. It is believed that optimum results will be achieved if the procedure outlined below is followed in each insulation application:

1. Develop exact requirements.

2. Determine service conditions.

3. Obtain accurate data on properties and characteristics of materials being considered.

4. Judiciously select the material that will most adequately satisfy service conditions and requirements.

5. Calculate the thickness to be installed based on requirements.

6. Select accessory materials as determined by requirements, service conditions, and the insulating material.

7. Prepare details of design and specifications that will result in a suitable application for conditions, requirements, and materials selected.

8. Carefully and thoroughly inspect materials and application techniques during installation.

9. Periodically inspect and effectively maintain the insulation after it is in service.

THE trend in recent years has been toward the increased use of refining processes operating at subatmospheric temperatures. The high cost of obtaining and maintaining low-temperature demands the application of insulations that yield a maximum of dependable service and thermal efficiency. Low-temperature conditions necessitate special insulating materials; however, designers, contractors, and insulation manufacturers have done much to improve results that can be obtained in this field by research and experimentation.

New insulation and accessory materials, better designs, and improved application techniques have been developed. The problem in each particular application is to obtain the insulation that will most effectively and economically accomplish the desired results. Fundamentally, the primary purpose of thermal insulation is to control the flow of heat. On this basis, conductivity is the most important property of an insulating material. Requirements of the particular installation may, however, indicate other properties to be of paramount importance.

In order to make an intelligent analysis of an insulation problem, the following information must be developed first: (1) Requirements, such as heat transfer rate, resistance to fire, resistance to mechanical abuse, etc.; and (2) service conditions, such as maximum and minimum operating temperatures, weather exposure, humidity, etc.

After these data are known, a satisfactory solution can be determined. The over-all efficiency and dependability of the insulation will be controlled by five basic factors:

1. Proper selection of materials based on requirements and service conditions.
2. Adequate design and specifications determined by materials selected, requirements, and service conditions.
3. Quality of the workmanship of the insulating craftmen.
4. Careful inspection of materials and methods of application during installation.
5. Periodic inspection and maintenance of the insulation in service.

It is the purpose of this paper to present a general discussion of the above factors to serve as an aid in analyzing low-temperature insulation problems encountered in petroleum refineries.

Insulation and Accessory Materials

In the selection and design of an insulation for low-temperature service, the engineer has a wide range of thermal insulating materials from which to choose. Some materials are accidental discoveries, but, in general, they are the result of years of research, development, and practical experience.

1. **Vegetable cork:** Cork is obtained from the outer bark of the cork oak tree. The bark has a cellular structure with more than 50 per cent of the volume in air cells, the still air trapped in cells acting as a barrier to heat flow. Cork insulation is made from granulated cork, molded, compressed, and baked into the required shape. It is available in blocks, sectional pipe covering, and shaped fitting covers. Granular cork is also available for loose fills.

2. **Mineral wool:** Mineral wool is made by exposing a thin stream of molten blast furnace slag or glass to a high velocity steam jet. Primary product is a wooly mass of fine, pliant, vitreous fibers. As an insulation, it is available as loose wool which is the form in which it is first produced; granules which are loose wool refined and granulated; blankets or batts; and blocks or pipe coverings formed by compacting, felting, and adding a resin or asphaltic binder.

3. **Rock wool:** Rock wool is similar to mineral wool—actually it is a mineral wool. It is made by exposing a thin stream of molten rock to a high velocity steam jet. Physical qualities of the wool depend upon the type or class of rock used. Rock wool is available as loose or granulated material, in blankets or batts, and in molded blocks and pipe coverings.

4. **Cellular glass:** Cellular glass is made from a mixture of pulverized glass and pure carbon which is baked in an oven at high temperatures. A reaction occurs in which carbon gases are formed causing cellulation of the molten mixture. The result is a product which contains more than 5 million cells of inert hermatically sealed air per cubic feet. Cellular glass is avail-

*Humble Oil & Refining Co., Baytown refinery, Baytown, Tex. Presented at Petroleum Mechanical Engineering Conference, A.S.M.E., Kansas City, September 23, 1952.

able in blocks or as sectional pipe covering.

5. **Cellular rubber:** Several special processes are used to produce celltight and gastight cellular rubber. One type is made in molds under high pressure and sufficient heat for partial vulcanization. After removal from the mold, the rubber expands and is then vulcanized. Another type is an expanded synthetic rubber similar in appearance to sponge rubber with many small individual cells filled with nitrogen gas. Cellular rubber is generally available in sheets only.

6. **Glass fiber:** Glass fiber insulation is distinct from mineral wool in that glass fibers are made to definite formulation with a uniformity not found in mineral wool. Fibers are made by dropping molten glass through tiny orifices and blowing with air or steam to attenuate the fibers. Glass fiber insulation can be obtained in boards or as formed pipe coverings both of which are made from fibers approximately 0.00055 in. in diameter compressed and treated with a thermosetting binder. It can also be obtained as loose fibers or in batts and blankets.

7. **Plastic foam:** Plastic foam is an expanded high molecular weight polymer with a distinct cellular structure consisting of a multitude of unit sealed cells. Several base plastics are used, the more common being polystyrene and urea formaldehyde. Properties of foams will vary with the type of base plastic used. In general, foams are available in blocks only; however, one manufacturer markets a shredded material.

Various forms in which an insulation can be obtained will have a definite bearing on the selection for a specific application. There are essentially three basic forms: (1) rigid, (2) flexible, and (3) granular.

Rigid insulation includes blocks, boards, beveled lags, curved segments, sectional or molded pipe coverings, molded fitting covers, etc. This form has been used more widely than others because it is easy to install, support, and protect against weather and moisture entry. It is generally less subject to abuse and mechanical damage; hence, does not require as much protection as other forms. If properly applied, maintenance can generally be accomplished with a minimum of expense.

Flexible insulation includes blankets, batts, felts, sheets, etc. Insulation in this form has been highly successful in some fields but has been found to possess a number of disadvantages in refinery service. It is subject to mechanical damage and is generally quite absorbent; consequently, expensive protective weatherproof coverings are a necessity. It is easily compressed so that it is difficult to know what actual thickness will be obtained upon installation. In addition, extensive supports and attachments are required to prevent sagging. The primary advantage is the ease with which it can be adapted to irregular shapes.

The granular form serves a special purpose in many installations and might be considered a supplement to other forms. For general insulating service, it is subject to many objections. It compacts or settles after installation, reducing thermal efficiency; and it must be totally supported and adequately encased to prevent moisture entry. However, it serves quite satisfactorily as a fill around irregular shapes and cavities enclosed by a rigid insulation, and provides the only practical means of insulating these surfaces.

Properties of insulating materials . . . All insulating materials possess certain inherent properties. These properties vary considerably in different materials and the relative importance of each will generally be determined by service conditions and results desired. The importance of thoroughly analyzing these properties with respect to service conditions cannot be overemphasized if a successful installation is to be obtained. Table 1 gives some of the more important properties of the insulating materials previously discussed.

The most important property of a thermal insulation is heat conductivity. This property is generally referred to as the "K" factor which expresses the B.t.u. per hour that will be passed through 1 sq. ft. of the material 1 in. thick for each degree Fahrenheit temperature difference between surfaces. The lower the "K" factor, the greater is the resistance to heat flow. This factor is the basis used in calculating the amount or thickness of an insulation required for specified operating conditions.

All other things being equal, the most economical selection is obviously the material with the lowest "K" factor. Unfortunately, the selection of an insulating material is not this easy. For one thing, the published conductivity of a particular material is determined by laboratory tests of a dry sample. It is difficult to attain this value under service conditions due to application joints, moisture or water absorption, metal fastenings, etc. It will be found in many cases that the material with the lowest conductivity will be the most expensive to apply and maintain or, for other reasons such as upper temperature limit, fire resistance, etc., may be unsatisfactory for applied conditions. The most practical approach is to assign a relative weight to conductivity

TABLE 1—PROPERTIES OF VARIOUS INSULATING MATERIALS*

Property—	Cork board	Mineral wool board	Rock wool board	Cellular glass block	Cellular rubber	Glass fiber board	Plastic foam
Density, lb. per cu. ft.	7.5 to 10	14 to 17	14 to 18	9 to 11	8	6 to 9	1.6
Specific heat	0.40	0.29	0.27	0.20	0.27	0.25	.....
Upper temperature limit, °F.	200	150	150	800	150	200	150
Coefficient of expansion per °F. × 10^{-6}	33.9	4.9	4.5	4.0	24	4.0	.....
Compressive strength, psi. for 5 per cent compression	6	4.5	5.0	140	40	.....	20
Water absorption, per cent volume 24 hours submerged	5.2	3.3	2.0	Negligible	0.2	.....	1.5
Moisture absorption from air, 96 hours at 90 per cent rel. humidity, per cent volume	1.9	1.0	0.7	Negligible	0.1	.....	Negligible
Water-vapor permeability, grains per sq. ft. per hr. per in. Hg pressure differential	9.0	35	38	0.0	0.0	.....	Negligible
Fire resistance, per cent combustible	94	27	29	0	100	.....	100
Conductivity, B.t.u. per hr. per sq. ft. per °F. per in. mean temperature:							
60° F.	0.27	0.31	0.32	0.43	0.22	0.27	0.28
0° F.	0.25	0.28	0.285	0.41	0.21	0.22	0.25
—40° F.	0.237	0.26	0.27	0.345	0.205	0.19	0.235

*Data from manufacturers publications and Stone.[1]

as with other properties, and to select the material that will most economically accomplish desired results.

Density or weight per cubic foot gives an indication of the relative ease of handling which will have some bearing on installation costs. It will also determine the total dead load of an installation. Density multiplied by specific heat gives the heat capacity of an insulation. A high heat capacity is of value in cases where it is necessary to prevent a sudden or rapid temperature rise in the event of a refrigeration failure. Conversely, a low heat capacity is desirable in installations where there is a rapid cycling from hot to cold.

Upper temperature limit is the maximum temperature to which a material can be subjected without causing adverse effects such as breakdown of the binder, excessive shrinkage, etc. This property is important since most refineries periodically steam out a large percentage of process vessels and piping for cleaning, inspection, or maintenance purposes.

The coefficient of expansion or linear change with temperature should closely approach that of the wall material over which the insulation is applied. Otherwise, excessive stress will be placed on the bonding agent and the insulation will part at joints, crack, or tear away from the wall. Most insulations are installed on equipment fabricated from carbon or alloy steels which have a coefficient of linear expansion in the range of 6 to 10 $\times$ 10^{-6} per °F. No insulating material currently available has a figure equal to this; however, the wider the variation, particularly on equipment that is subject to cyclic operation or large temperature fluctuations, the greater the possibility of insulation damage.

Compressive strength gives an indication of the amount of support required for a particular installation. On large towers, a material with high compressive strength will require fewer supports to prevent sagging; hence installation costs will be less. In addition, high compressive strength aids in reducing damage from mechanical shock or abuse, such as workmen climbing on or leaning ladders against the insulation. Compressive strength also gives some indication of handling properties of the material.

Water absorption is an important factor since a large percentage of refinery insulation is exposed to the weather. Any defect in the exterior protective or weatherproof covering presents the possibility of water entering the insulation. Water increases the thermal conductivity considerably and in many cases will cause rotting or disintegrating of the material. Flexible and granular insulations are generally much more water absorbent than the rigid form.

Moisture absorption and **water vapor permeability** are closely associated properties that constitute two of the most important properties of low-temperature insulating materials. Moisture (water vapor) penetration of various materials dictates the necessity of providing an effective vapor barrier on the warm side of low-temperature insulations. There is always some moisture present in the air as invisible vapor. The amount the air will hold without forming fog or dew—indicating a saturated atmosphere—varies sharply with the temperature.

Water vapor moves independently of other constituents of air and tends to travel from regions of high temperature toward those of lower temperatures where its pressure is less. Vapor pressures at saturation for various temperatures are shown in Fig. 1. Under normal atmospheric conditions, saturation is seldom encountered and relative humidity is used to indicate the per cent of saturation. It is apparent from the curve that the vapor-pressure differential between the warm and cold sides of an insulation is the motivating force responsible for migration of water vapor through an insulation.

It should be borne in mind that water vapor passes readily through many materials that are impervious to air or water. Any vapor that gets into an insulation through penetration or breaks in the vapor barrier will continue to migrate until the area of lowest temperature is reached or until it encounters an impermeable surface. This moisture would be of little consequence if it remained in the vapor phase; however, in most cases it condenses to form water or ice depending upon the temperature.

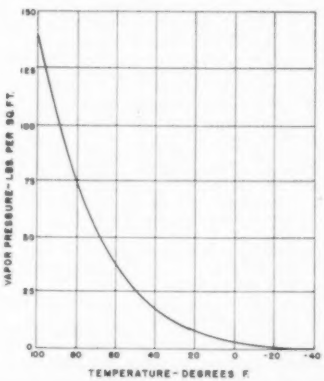

Fig. 1—Saturation vapor pressure of water at various temperatures.

The total heat transmission of an insulation is the sum of the solid-phase conduction, gas-phase conduction, and radiation.[2] In general, transmission by the solid phase will increase in approximately direct proportion to the weight per cent of water or ice formed.

Combustibility . . . The last property to be discussed, an important one in refinery service, is fire resistance or combustibility. Two basic requirements are considered important:

1. The insulation should add as little fuel to a fire as possible—complete incombustibility is desirable but not absolutely essential.

2. The material should be sufficiently fire resistant to adequately protect the equipment it covers.

Values assigned to various properties in Table 1 are indicative only. Mineral wool board, for example, is marketed by several different companies. Each company uses different manufacturing techniques and as a consequence, properties of final products vary considerably even though they may all come under the general class of mineral wool board. In analyzing an insulation problem, accurate data on properties of specific materials being considered must be obtained to permit intelligent selection of a material that will accomplish desired results.

Accessory Materials

The application of an insulation requires a variety of accessory materials such as adhesives, vapor sealers, weatherproof and fireproof coverings, mechanical attachment devices, etc. One accessory material is the protective coating applied for corrosion protection to the surface of the equipment to be insulated. There is disagreement as to whether this accessory is necessary since it is felt by some that a properly applied vapor seal will preclude the possibility of moisture reaching metal surfaces.

This is an ideal condition but one seldom achieved in practice particularly in humid atmospheres. Even if a perfect vapor seal could be obtained and maintained, the moisture absorbed by some insulating materials prior to application will migrate to the surface of the equipment after the temperature is lowered and initiate corrosive action. Experience indicates that the expense

required for application of a protective coating is well justified.

Adhesives . . . There are several types of adhesives available, some of which are better suited for a particular application than others. The oldest and one of the most widely used adhesives is hot asphalt. It has several inherent disadvantages though, in that fired kettles required for melting the asphalt are prohibited by safety regulations in many refineries. Also, erection asphalt has a melting point or upper temperature limit of 125° to 175° F.

The upper temperature limit of the adhesive is equally as important as that of the insulant, and a material must be used that will maintain adhesive properties at the maximum anticipated temperature. Cold application adhesives are generally of two basic types: (1) asphalt cutback which is essentially petroleum asphalt dissolved in a petroleum solvent, and (2) asphalt emulsion which is petroleum asphalt dispersed in water. Some of these materials are available with an upper temperature limit of 300° to 450° F. which is obtained by the addition of mineral fillers to the asphaltic compounds.

In addition to upper temperature limit, there are several other points to remember when using adhesives. A material should not be used that sets to brittle hardness if wide temperature differences are likely to be encountered, since the difference in expansion characteristics of the insulation and the vessel or pipe wall will break the adhesive bond. Further, joints should be as small as possible since the conductivity of the adhesive is usually high. Stone[3] points out that, other things being equal, joints only ⅛ in. wide completely filled with adhesive will transmit enough heat to raise the total heat transfer of the insulation some 10 to 12 per cent.

Mechanical attachment or securement of the insulation is a necessity regardless of whether or not an adhesive is used. The most commonly used securement devices are bands, wires, welded studs, and welded hairpins. The latter two must be attached to the vessel or pipe wall; hence provide through metal paths for heat flow. The probability of moisture being present in any low temperature insulation dictates the desirability of using corrosion resistant materials. Monel and stainless steel are commonly used since they possess good tensile strength and excellent corrosion resistant properties. Galvanized and copper covered steel wire and bands are frequently used but their life is considerably less than either stainless steel or monel.

Design and Specifications

The second basic factor which determines the efficiency and dependability of an insulation is adequate design and specifications. Each low-temperature application must be individually analyzed and details of design and specifications prepared that will result in an insulation capable of satisfying specified requirements.

The design, of course, will vary considerably with what is desired of the insulation. This may be simply a matter of obtaining the most economical thickness. On the other hand, operational requirements, such as accurate process control, refrigeration economy, and elimination of excessive condensation on exterior surfaces, may be of primary importance with economic considerations secondary.

Other factors which affect the design are whether the equipment will be indoors or outdoors, anticipated life of the equipment, vibration or mechanical abuse that can be expected, fire hazard involved, maximum and minimum temperature conditions, nature of operation (cyclic or constant), weather conditions with particular reference to humidity, deleterious effect of product spills, heat capacity necessary in event of refrigeration failure, and the number of hours' operation each year.

TABLE 2—WATER-VAPOR PERMEABILITY OF SOME WEATHERPROOFING MATERIALS*

Material—	Permeability†
1. ⅛-in. film, rubber emulsion adhesive	0.60 to 0.75
2. Approx. ⅛-in. emulsified asphalt, asbestos fiber and filler	1.8 to 4.5
3. Approx. ⅛-in. asphalt, fiber and filler (solvent type plastic)	0.10 to 0.80
4. 15-lb. asphalt saturated rag felt roofing	4.0 to 20.0
5. 15-lb. asphalt saturated asbestos felt roofing	1.0 to 8.0
6. 20-lb. asphalt saturated asbestos felt roofing, coated	1.0 to 2.0
7. 35-lb. cold application asbestos felt, coated two sides	0.0
8. ¼-in. asbestos cement sheet	6.0 to 7.0
9. Paper backed aluminum foil, 110 lb. per 3,000 sq. ft.	0.40
10. 1⅜-in. stone concrete (1:2:4 mix)	2.9
11. ½-in. portland cement plaster (1:2 mix)	12.0 to 20.0
12. Combination: ⅛-in. No. 3, 1 course No. 5, ⅛-in. No. 3	0.01 to 0.10
13. 25/32-in. plain wood fiber insulating board	30.0

*Date from a publication by Stone.[1] †Water-vapor permeabilities expressed in grains per square foot per hour with a pressure difference of 1 in. of Hg across the sample.

Minimum cost . . . It is generally conceded that the most economical insulation thickness for a particular application is that thickness at which the sum of the annual maintenance, refrigeration, and the amortization of the first cost of this insulation costs is a minimum. This thickness, however, may not be enough to prevent excessive surface condensation in areas of high humidity or to permit accurate control of process temperatures.

Calculations necessary to determine the required thickness for a particular application have been omitted from this paper; however, excellent reference material can be obtained from information prepared by Stone,[2,3] Bradley and Stone,[4] and McMillan.[5]

Vapor barrier . . . One of the most important phases of low-temperature insulation design is the provision of an adequate vapor barrier on the warm side of the insulation. The extent of protection necessary will vary somewhat with operating conditions. Intermittent or cyclic operation requires less protection since during the off period or high-temperature part of the cycle, the vapor pressure of the normally cold side will rise tending to force the moisture out of the insulation. However, if low temperatures are maintained over a long period of time, an effective vapor barrier must be provided to prevent loss of thermal efficiency and serious damage to the insulation.

The most effective vaporseal is a metal sheathing with welded joints. This type of seal has several other advantages in that it is weather and fireproof, and resistant to mechanical damage. It has not proved attractive for refinery installations though, since it is expensive to install, makes inspection and maintenance of equipment difficult, and poses the problem of a pressure differential across the sheathing due to construction of the entrapped air as the temperature is lowered.

A number of so-called vapor barrier materials are currently available. Inasmuch as most of these are subject to moisture penetration when a vapor pressure differential exists, they might more aptly be called vapor resistive materials. Table 2, compiled by Stone,[1] presents permeability values for some of the more commonly used vapor barriers. These should be considered indicative rather than specific values since they will vary considerably under applied conditions.

The degree of impermeability required of the vapor barrier will depend

to an extent on the insulating material selected. An insulant that is impermeable itself, such as cellular glass, will require protection from vapor penetration only at the joints. Use of a joint adhesive with low vapor permeability on this material will reduce exterior vapor barrier requirements to a minimum. On the other hand, insulants with high permeability, particularly blankets or felts, require the maximum in exterior vapor resistance.

A vapor barrier, to remain effective, must be adequately protected from mechanical abuse and from the weather, if the equipment is outdoors. It is desirable, of course, from the economical standpoint to use only one material for the final coat. The solvent plastic asphaltic compounds (cutbacks) possess relatively good vapor resistant properties and at the same time provide adequate weather protection.

A relatively low degree of abrasion resistance can be obtained by applying these coatings over a reinforcing membrance such as poultry netting or glass cloth. If fire resistance is a requirement of the insulation, compressed asbestos cement sheets, metal, or fire retardant felt covering is necessary. This, again, will depend to some extent on the insulant selected since certain materials will themselves provide adequate protection of equipment in the event of fire exposure.

Protecting finish . . . Another factor to consider is the necessity of protecting exterior finish materials from possible damage by product leaks, drips, or spills. Asphaltic compounds are soluble in most liquid hydrocarbons and if used as the final coat, must be protected by suitable metal shields at likely points of contact with process liquids.

In the design of a new process unit or an addition to an old unit, considerable care and conscientious attention must be devoted to the arrangement of towers, drums, exchangers, and piping to insure that ample space will be allowed for application and maintenance of insulation. If sufficient space is not provided, installation costs will be increased, the optimum installation will not be obtained, and maintenance will be difficult and expensive.

It is good practice to insulate each line separately rather than nesting two or more lines and insulating them as a unit. It is also desirable to install valves with stems looking down, wherever feasible, so that condensation on cold stems or packing gland leaks will not drip on the insulation. Adequate supports should be provided even though an adhesive is used.

In designing supports, care must be exercised to minimize through metal paths for heat flow. The cost of extracting heat is considerably more than the cost of supplying heat and through metal paths, even though they may be small, can add appreciably to over-all refrigeration costs.

Specifications are essentially the connecting link between engineering design and field application. They should be sufficiently rigid and detailed to assure that desired results will be achieved. However, unnecessarily rigid or complicated specifications invite difficulties and incur unwarranted expense. Specifications should be prepared by someone familiar with the equipment to be insulated, operating and atmospheric conditions to which the insulation will be subjected, and physical properties and characteristics of the various materials to be used in the installation.

Also, it will pay dividends to have specifications either prepared or reviewed by someone familiar with field application so impractical details can be corrected before field problems arise.

Installation and Maintenance

Field application is the third basic factor affecting the efficiency and dependability of an insulation job. Regardless of how much care is exercised in the selection of materials and preparation of design details and specifications, over-all results will be no better than the quality of the workmanship obtained during installation. Some materials such as glass fiber insulations or coal tar compounds are irritating to the skin and eyes, and workmen will not devote as much conscientious effort to their application as to materials that do not cause physical discomfort.

Certain materials are easier to handle than others. Weatherproofing compounds with equal vapor and weather resistant properties will be found to vary widely in the case of trowel or spray application. Materials that require highly skilled or specially trained craftsmen for application should be avoided as much as possible.

Better results at less cost can generally be obtained if materials that can be simply and easily installed by semi-skilled craftsmen are specified. The average insulation crew will probably be composed of as many "green" men or apprentices as skilled men. For this reason, design details for flashings, supports, etc., should be as simple as is consistent with results desired.

Inspection

Field inspection will aid immeasurably in assuring that the installed insulation conforms to design and specications as far as the quality of materials and workmanship and the method of application is concerned. Each phase of the installation should be carefully checked as the work is being done. After the second layer of insulation is applied, it is too late to find out if the bands supporting the first layer were installed on 9-in. centers as specified. The field inspector is more concerned with characteristics affecting application than with properties such as conductivity or vapor resistance.

For example, specifications may call for a weatherproofing material that should not be applied when the atmospheric temperature is 45° F. or below or the relative humidity is 80 per cent or above. This type of information is of vital importance and the inspector should be completely familiar with limiting properties of all materials to be used in order to effectively control application.

Maintenance

Once the insulation is placed in service, prompt and adequate maintenance is the major factor affecting its life. Periodic inspection will aid in locating breaks in the exterior finish, loose or broken banding, places where product spills have adversely affected the finish, defective flashing, etc. These damaged spots are generally of a minor nature when first detected and repairs can be made at small cost. However, if repairs are delayed, moisture or water penetration will cause progressive damage and eventually complete breakdown of large areas will occur. Repairs then become quite expensive not only because of the larger area involved but also because shutdown of the equipment is often required and process losses will be incurred.

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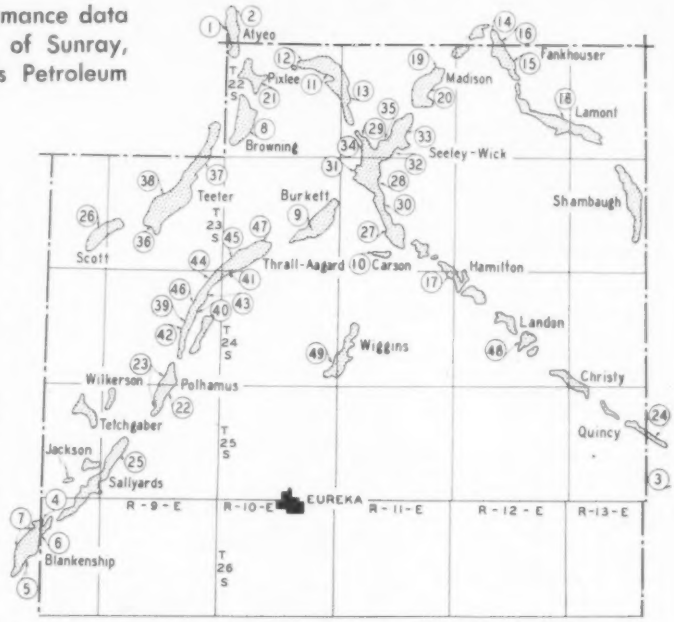
JOURNAL REPORT:

Water Flooding in Kansas' "Golden Lane"

Field inspection and performance data show modern engineering of Sunray, Cities Service, and Phillips Petroleum Co. projects

EACH year the Kansas-Oklahoma water-flood operators and the A.I.M.E.-Kansas section conduct an all-day tour of significant water-flood projects in some area of eastern Kansas or northeastern Oklahoma. This fall the 310-man tour group visited the famed Bartlesville "Golden Lane" sand stringer area of Greenwood County, Kansas.

The Oil and Gas Journal attends these annual water-flood inspection tours and publishes photographs, production data, operational features, etc., connected with the water-flood projects. Material for the report at hand was assembled by the above sponsors together with Ward A. McGinnis producing organization, Eureka, Kans.



Map of Greenwood County, Kansas, showing the 52 water-flood projects tabulated in the accompanying large table. (Map keyed to table.)

Oil has been produced in Greenwood County for almost 50 years, the discovery well being drilled in 1905 near Toronto. Discovery of Mississippian limestone production was made in Virgil field in 1916. First production from the Bartlesville "shoestring sand" was obtained in 1917, in Sallyards field. Additional Bartlesville production was obtained in Teeter field in 1921, in Browning, Burkett, and Seeley fields in 1922, and Aagard field in 1923. Development of these "Golden Lanes" of Bartlesville sand stringers progressed at a rapid rate in the middle 1920's.

Geology . . . The Bartlesville shoestring sands were found to occur in four trends of sandstone lenses that were deposited in the Cherokee shale of Pennsylvanian age. These trends were established as offshore bars on two separate shorelines by N. Wood Bass, of the State Geological Survey of Kansas. The Teeter and Quincy trends were deposited on one shoreline, the Sallyards and Lamont trends were deposited on another. It also was determined by Bass that the sandstone lenses of the Teeter-Quincy trends were deposited prior to those of the Sallyards-Lamont trends. Two of the trends intersect at Seeley-Wick field where a difference of approximately 50 ft. was found in the depth of the bases of the lenses.

Gas repressuring . . . These operations were initiated in the Bartlesville sand in 1935, and repressuring operations have been conducted in Browning, Burkett, DeMalorie - Sowders, Madison, Scott, Teeter, and Thrall-Aagard fields. Most of these projects, however, although generally successful, have been discontinued in favor of water flooding.

Early flooding . . . The Tonganoxie sand in the Douglas group, commonly known as the "Big Water" sand or simply the "Douglas" sand, occurs throughout most of Greenwood County at depths from 800 to 1,200 ft. As the production from the solution - gas Bartlesville reservoirs began to decline, poorer wells were plugged and abandoned. The plugging practices observed at the time seldom provided effective isolation of the Bartlesville sand from the upper water sand, and operators were quick to observe increases in production from wells in the vicinity of plugged wells.

Formalized and systematic water-flooding was authorized by the Kansas Corporation Commission in 1935, and the York State DeMalorie "C" lease became the first legal water-flood project in the state in the same year. This flood is still in progress and is now operated by Phillips Petroleum Co.

Water . . . Many of the water-flood projects in Greenwood County have used the Douglas water for flooding. However, variations in the thickness of the water sand in some areas, and the depletion of the water supply itself in other areas, has led to the use of water from the Arbuckle limestone, and surface water in many of the newer projects. Both "open" and "closed" water systems are used with the Douglas water, while "open" systems are generally used with either Arbuckle or surface water.

Oil recovery . . . It is estimated that 178 million barrels of oil have been produced up to July 1, 1952, of which 24.5 million barrels have been recovered by water flooding. The recovery of these 24.5 million barrels has required the injection of 211 million barrels of water. Water-flood recovery to date averages slightly more than 2,900 bbl. per developed acre. It will be

noted from the accompanying table that several projects have already recovered more than 6,000 bbl. per acre. If an average water-flood recovery of 5,000 bbl. per acre is assumed from an ultimate area of 20,000 acres, a total water flood recovery of 100 million barrels is indicated.

Before Flood:
34 bbl. per day of oil

Peak Flood:
1,797 bbl. per day

Sunray Oil Corp.'s Fankhauser Unit water flood is located in 4-22s-12e, Fankhauser field, Greenwood County —about 4 miles northeast of Madison, Kans. It is a fully electrified project, incorporating a number of features permitting ease of operation and high operating efficiency.

The development is on a 574-acre tract, originally comprising four leases, in which royalty interests were consolidated by unitization agreement. All working interest is owned by the operator.

Production is from the Bartlesville sand at 1,900 ft. and was initially developed during 1926 and 1927 by the drilling of 33 producing wells, 10 of which were plugged prior to secondary recovery development.

Combined production from the 23 active wells averaged 34 bbl. per day during the 12-month period preceding water injection, which was begun in February 1949. Progressive water-flood development resulted in sharp production increases, the rate averaging 1,797 bbl. daily in July 1950, which was the peak rate of production for the flood.

Flood development . . . Input wells were drilled on a five-spot pattern with 10-acre density. In the pilot project, a total of nine injection wells and two water-supply wells were drilled.

The indicated success of the pilot flood resulted in an extension development, completed in November 1949, in which nine additional input wells, one water-supply, and two oil wells were drilled. Four more input wells and one supply well were completed in April 1950 and three wells were completed in January 1951, making a total of 22 injection, four water-supply, and 25 oil wells. Two input wells and one oil well along the west lease line have since been plugged and abandoned, and one water-supply well has been shut down.

Injection system . . . Water meters and regulating valves, necessary to control injection rates, are located at two central manifolds, from which pipe lines radiate to each input well. Cement-lined pipe is used in the water system, and all lines are buried.

Injection wells were drilled with rotary tools and cased with 4½-in. pipe cemented at the top of the producing sand. Rotary cores were taken in the Bartlesville sand and the cores analyzed.

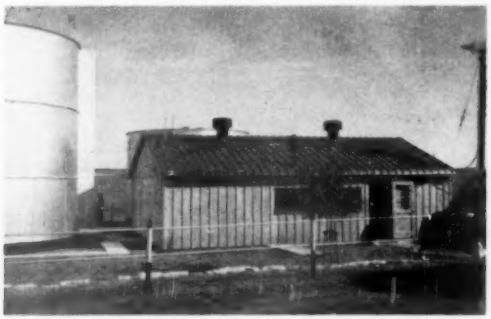
Cable tools were used to drill the current plug in the casing, clean the sand face, and to plug back in cases where shale sections were cut below the sand body, as a precaution against possible water channeling through fractures or bedding planes in the shale. The wells were not shot.

Water supply . . . Supply wells are completed in the Douglas sand, a salt-water sand about 100 ft. thick, at a depth of 800 ft. The water is ideal for the flood operations because its chemical analysis is similar to that of the interstitial water in the Bartlesville sand.

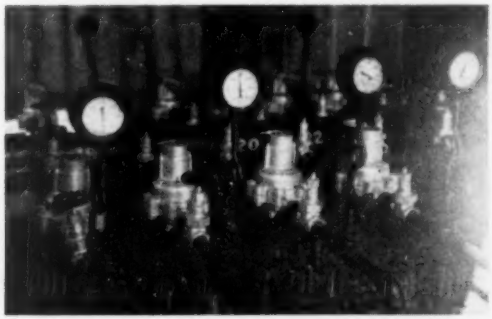
Filter plant . . . A water filtering and pressure plant was constructed and placed in operation in December 1949. The facilities were designed to maintain a closed system.

Return water is collected from the free-water knockouts and treaters in a 750-bbl. receiving tank, then pumped through pressure-type sand filters into a 1,500-bbl. clear-water storage tank. Water from the supply wells is pumped directly into this tank because this water is virtually free of solids and does not require filtering. Two horizontal triplex plunger pumps, driven by 60-hp. motors, pump water from storage into the injection system.

Automatic controls . . . Control equipment is provided to maintain predetermined operating levels in the clear-water storage tank, by automatically starting and stopping each electrically powered water-supply well when certain selected levels are reached in the storage tank. In addition, other automatic devices are installed which make the plant self-protecting and permit unattended operation, except that required for lubrication pumps and backwashing filters.



SUNRAY PRESSURE PLANT . . . A compact, all-electric or automatic water-pressure station furnishing 7,000 bbl. of water daily to the company's Fankhauser Unit.



INJECTION-WELL MANIFOLD . . . All water supply to the individual injection wells on Sunray's Fankhauser Unit moves through one of two such centralized control-metering manifolds.

Water-Flood Data on the 52 Water-Flood Projects in

Name of flood—	Operator	Producing acres		Depth (ft.)	Acre spacing	Net ft. of sand	Core data		First injection
		Developed	Total				Perm. (md.)	Porosity (%)	
ATYED POOL:									
1. Atyed	Ohio	280	280	2,190	8.8	35	29.8	19.0	7-47
1a. Atyed	Cities Service	150	150	2,460	10.0	18	48.0	17.0	2-52
2. Jones	Barbara	30	80	2,300	10.0	25	30.0	19.0	4-48
BATESVILLE POOL:									
3. Batesville	Bird-Sheed	(No information available)							
BLANKENSHIP POOL:									
4. Unknown	Branine-Goering	(No information available)							
5. Sallyards	Tide Water	350	1,000	2,480	10.0	35	53.0	18.0	3-49
6. Hughes	Franco-Central	80	80	2,500	15.0	84	67.0	19.0	9-51
7. Sallyards	Sohio	140	150	2,500	10.0	43	46.5	18.4	5-49
BROWNING POOL:									
8. Browning Unit	Sinclair	170	1,000	2,300	10.0	51	48.0	20.0	11-49
BURKETT POOL:									
9. Burkett Unit	Phillips	665	685	2,118	10.0	38	7.0	16.0	9-41
CARSON POOL:									
10. Carson Unit	McGinnis		200	1,985	10.0	(Flood being developed)			
DeMALORIE SOWDERS POOL:									
11. DeMalorie Sowders	Phillips	132	820	2,120	20.0	45	7.1	15.2	4-49
12. Pix Unit	Phillips	25	40	2,194	20.0	54	N.R.	N.R.	4-49
13. J. D. Clopton	Mid-Continent								
FANKHAUSER POOL:									
14. Childers	Harrogan	5	5	N.R.	20.0	N.R.	20.0	N.R.	N.R.
15. Fankhauser Unit	Sunray	246	246	1,900	10.0	24.2	78.0	20.0	2-49
16. Lauck Unit and McIlvain	Phillips	100	100	1,920	20.0	40.0	79.6	20.0	1-43
HAMILTON POOL:									
17. Patterson	Cities Service	200	200	1,850	10.0	45	30.0	17.7	9-46
LAMONT POOL:									
18. Lamont Unit	Cities Service	690	690	1,700	10.0	37	57.0	20.0	5-49
MADISON POOL:									
19. Kipfer-McGilvray	Magnolia	65	65	1,900	20.0	25	N.R.	N.R.	9-49
20. Madison	Cities Service	1,130	1,130	1,875	20.0	29	30.0	17.5	10-48
PIXLEE POOL:									
21. Browning Pixlee	Barbara	100	180	2,300	10.0	25	80.0	19.0	6-47
POLHAMUS POOL:									
22. Polhamus	Glenwood	260	260	2,300	10.0	34	12.0	20.0	4-49
23. Polhamus	Sohio	190	190	2,200	10.0	35	14.0	20.4	6-49
QUINCY POOL:									
24. Quincy	Burgin	65	400	1,550	4.8	30	6.0	19.5	1-50
SALLYARDS POOL:									
25. Ladd Unit	Ohio	205	205	2,400	Irregular	50	29.8	18.9	3-46
25a. Hoffman	Ohio	55	55	2,400	Irregular	39	26.8	17.7	8-51
SCOTT POOL:									
26. Scott Unit	Phillips	200	750	2,605	20.0	35	85.0	20.0	10-45
SEELEY-WICK POOL:									
27. Beal Unit	Phillips	153	600	1,963	10.0	70	8.4	16.2	7-50
28. Clopton	Cities Service	250	250	1,950	10.0	36	21.0	17.0	3-46
29. Cragan									
29a. Greenwood	Cities Service	45	45	2,050		30	30.0	16.0	1-52
30. McGilvray Unit	Phillips	133	290	1,994	20.0	37	6.7	16.9	6-50
31. Seeley Unit	Magnolia	555	555	1,975	10.0	32	27.0	18.0	1-43
32. Seeley-Wick Unit	Phillips	253	253	1,960	13.0	30	12.0	18.0	12-43
33. Wick	Skelly	600	600	1,950	20.0	27	N.R.	N.R.	8-47
34. York DeMalorie and O'Neal	Phillips	280.5	280.5	1,997	10.0	47	28.7	17.4	5-35
35. York-Wescott	Phillips	80	80	1,984	12.8	29	N.R.	N.R.	11-43
TEETER POOL: (Kirkpatrick & McGuire for)									
36. Morris-McGinnis	Ref. Oil Corp.	20	516	2,550	10.0	36	14.0	18.0	11-51
37. Shambaugh*		73	74	2,391	10.3	32	79.8	19.8	8-44
38. Teeter	Cities Service	1,160	1,160	2,550	20.0	37	30.0	17.5	11-47
THRALL-AAGARD POOL:									
39. Aagard Unit	Phillips	47.5	47.5	2,150	6.4	40	16.0	17.0	7-37
40. Bratton	Orr	(No information available)							
41. Cartwright Unit	Phillips	107.5	165	2,350	15.0	35	14.0	18.8	3-52
42. Card Block	Phillips	110	110	2,170	13.0	39	10.0	16.0	9-41
43. Lewis Unit and Cannon Lease	Phillips	80	80	2,310	12.8	48	10.0	16.0	5-45
44. E. Marshall Lease	Arkansas Fuel	84	84	2,335	7.6	37	41.4	20.2	12-44
45. Martindell-Teter	Ohio	316	350	2,296	Irregular	61	13.6	16.5	5-48
46. Olson-Anderson	Ohio	98	98	2,170	Irregular	53	17.1	17.8	4-44
47. Thrall-McKee	Sinclair	644	721	2,300	Irregular	31	39.0	18.0	6-49
VIRGIL POOL:									
48. Johnson	Landon	(No information available)							
WIGGINS POOL:									
49. Wiggins Unit	W. A. McGinnis		530	1,864	10.0	(Flood being developed)			

*As of April 1, 1952.

Kansas' "Golden Lane" Pools (Greenwood County)

No. of wells			Type injection wells	Water supply		Daily water input	Bbl. water injected	Water-flood recovery		Primary recovery	Surface injection pressure	Present daily production	
Oil	Input	Supply		Source	Treatment			Barrels	B/A	B/A		Oil	Water
39	24	1	23D, 1E	Arbuckle	Lime	5,083	5,654,919	1,073,368	3,833	4,500	800	498	4,167
15	15	1	D	Arbuckle	Treat-Right	881	158,577	14,167	94	7,800	N.R.	200	179
6	3	1	D	Arbuckle	Lime	975	932,000	75,038	2,400	3,500	550	44	600
47	42	1	D	Arbuckle	Lime	7,500	2,817,000	470,000	1,342	N.R.	300	1,000	1,400
17	12	2	D	Douglas	Contol	2,000	389,866	6,700	84	8,000	N.R.	140	250
17	13	1	D	Arbuckle	Lime	3,000	1,228,034	202,987	1,100	6,000	250	550	1,034
69	17	5	C & D	Douglas	None	3,500	2,272,715	0	0		240	270	200
85	68	5	64D-4C	Douglas	Formaldehyde	10,436	29,186,647	4,473,476	6,725	4,600	800	708	8,913
44	8	4	C	Douglas	Bianol "A"	1,589	1,485,698	105,043	799	7,690	850	472	118
3	2	0	C	Douglas	Bianol "A"	314	580,061	50,729	2,029	9,902	820	48	120
1	1	0	C	Douglas	None	151	129,923	N.R.	N.R.	N.R.	181	N.R.	N.R.
27	20	4	D	Douglas	Contol	5,200	5,248,303	1,131,368	4,599	3,960	600	417	4,200
7	6	1	1D, 5C	Douglas	Bianol "A"	1,325	2,415,826	231,062	2,311	3,110	100	56	1,115
29	20	4	D	Douglas and Willow Creek	Alum	4,669	8,500,125	1,196,015	8,725	6,679	740	252	2,405
60	40	4	D & C	Verdigris River	Calcium hydrox.	7,683	6,143,964	465,681	1,060	6,298	500	464	4,995
5	6	1	C	Douglas	None	1,658	920,318	114,314	1,760	N.R.	500	417	278
42	31	3	D & C	Verdigris River Douglas sd.	Calcium hydrox.	7,503	5,160,819	181,856	466	5,462	300	615	1,760
18	11	2	D	Douglas	Dearborn No. 844	2,300	5,140,000	155,500	1,550	4,300	400-600	56	1,600
30	20	3	D	Douglas	Hexametaphosphate	5,000	4,000,000	N.R.	N.R.	N.R.	450	550	1,500
30	28	3	D	Douglas	None	3,600	3,115,866	472,300	3,825	N.R.	400	668	3,400
12	11	1	D	Arbuckle	Lime-alum	2,200	1,100,000	133,000	2,000	1,500	750	175	600
39	29	4	28D, 1C	Douglas	Lime	5,103	9,561,860	882,778	4,306	4,743	800	168	3,672
9	6	Water from adj. lease	D	Douglas	Lime	918	214,981	26,909	489	5,500	800	106	137
40	11	3	C	Douglas	Formaldehyde	4,633	6,563,022	268,013	1,340	7,000	50-125	229	1,838
59	16	1	D	Arbuckle	Lime	11,504	2,295,802	185,499	1,212	7,700	100-325	2,016	1,000
26	21	3	D	Douglas	None	3,780	7,325,640	661,644	3,390	4,722	550	165	2,760
5	5		3E, 2D	River	Alum sulfate	1,333	240,099	2,336	52	3,650	664	45	39
32	6	2	C	Douglas	Formaldehyde	2,355	1,561,602	111,890	844	4,210	400-600	284	657
63	60	11	D	Douglas	None	12,965	24,448,000	3,374,000	6,070	6,000	630	437	13,500
24	19	2	1D, 18C	Douglas	Formaldehyde	2,382	6,730,522	490,434	1,938	2,842	200-400	103	920
40	14	2	1D, 13C	Douglas	Dearborn No. 852	3,079	4,166,566	384,558	642	3,442	350	264	1,800
33	32	2	D	Douglas	Lime	6,700	17,601,287	1,907,836	6,802	5,779	150-250	349	4,740
12	9	0	5D, 4C	Douglas	Lime	272	2,403,115	188,552	2,357	2,960	Gravity	38	272
2+2 T.A.	2	1	C	Douglas	None	242	57,570	None		3,000	280	3.3	
8	6	3	5D	Douglas	None	1,007	5,103,125	137,076	1,878	7,131	319	22	146
46	28	4	Both	Lake & Doug.	Alum	5,827	4,236,310	196,238	634	6,261	650	420	1,186
4	1	1	C	Douglas	None	417	2,500,275	361,284	7,606	4,720	335	26	94
16	11	1	1D, 10C	Arbuckle	Lime	4,450	491,033	20,578	191	6,000	0-450	374	600
16	9	1	2D, 7C	Douglas	Formaldehyde	1,958	6,208,046	873,504	7,941	4,170	750-800	84	1,378
11	9	1	2D, 7C	Douglas	Formaldehyde	1,742	4,349,875	535,438	6,674	7,850	150-650	81	929
11	5	1	C	Douglas	None	1,137	1,796,891	314,262	3,741	6,370	150-600	175	542
41	32	1	29D, 3C	Arbuckle	Lime	6,431	6,068,697	1,076,901	3,408	6,200	800	938	3,810
13	8	2	8D, 1C	Douglas	Lime	2,161	2,645,759	616,366	6,289	4,950	918	72	1,045
78	62	8	D & C	Douglas	Sodium hex. and Argund	10,300	10,625,760	1,430,394	2,222		465	2,567	10,212

WATER-FLOOD OIL . . . This electrically driven unit pumper on Sunray's Fankhauser Unit is one of 23 active producers. This successful flood has individual oil wells which have recovered 100,000 bbl. plus of secondary (water-flood) oil.

WATER-SUPPLY WELL . . . Four electrified water-supply wells on Fankhauser Unit are started and stopped automatically from remote-control devices at central pressure plant. Guard in foreground protects a water-injection well, which is boxed and insulated to prevent freezing in winter. Water formation is Douglas sand.

Reservoir data and recoveries . . . Average net thickness of the Bartlesville oil sand in the flood project is 24.2 ft. Porosity averages 20 per cent and permeability 78 md. Primary recovery totaled 1,307,000 bbl. from date of initial production to water injection.

The secondary-recovery operation has accounted for 1,166,300 bbl. cumulative production through June 1952. During this period 5,248,300 bbl. of water were injected, of which 2,554,500 bbl. were produced with the oil and reinjected into the formation. Return water production averaged about 4,200 bbl. per day during June.

Cities Service's Madison Block . . .

Discovered in 1923, gas pressured in 1931, water flooded in 1948

The Madison block includes 11 leases which have a total of 1,440 acres of which 1,130 acres have water-flood possibilities. At the present time the block has 42 producing oil wells, 31 water-input wells, and 3 water-supply wells.

The pool was initially developed by Cities Service in 1923. Gas repressuring was commenced on the block in 1931. The block was partially converted to a water-flood project in October 1948 by converting seven oil wells to water input on a 20 acre five-spot pattern. The initial project obtained the water supply from three Douglas sand wells.

As the flood progressed the water supply was augmented by water taken directly from the Verdigris River. The gas repressuring was discontinued in February 1952. At present the water-flood project is approximately two-thirds developed.

Filter plant . . . The water handling system is designed so that it will ultimately have a capacity of 15,000 bbl. per day including all return water expected. The water treating plant is located so that water to be produced with the oil will flow by gravity to the central filter plant. Produced water and fresh water are mixed, treated, and filtered for injection into the sand.

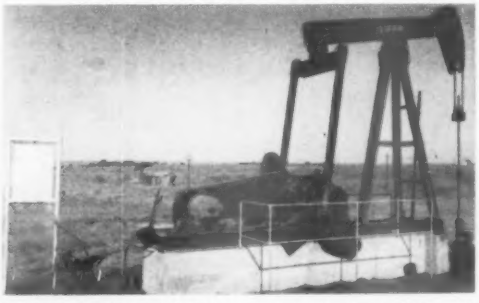
The water plant consists of two 1,600-bbl. treating and settling tanks, eight gravity-type wood filters, and three 5,000-bbl. per day capacity triplex pumps. The water is treated with alum fed into the incoming water by an Omega feeder.

Statistical Information

Oil produced to October 1, 1948, totals 2,839,441 bbl. Estimated oil increase due to gas repressuring, 1,477,959 bbl.

First water input commenced October 1948. Number of water input wells in

WATER-PRESSURE PLANT . . . Cities Service unit being inspected by 310 Kansas-Oklahoma water flooders on annual A.I.M.E. tour. This water-pressure station, designed to handle 9,000 bbl. per day, contains motor-triplex pumps. Plant includes water treaters and filters.



WATER-FLOOD OIL WELL . . . This electrically driven unit pumper with motor starter at left is one of 42 wells on Cities Service Oil Co.'s Madison Block water flood. Both oil wells and water-pressure plant are electrically powered.

July 1952 was 31. Daily water input is 8,500 bbl. per day.

The daily production of oil before water flooding was 200; daily production of oil, July 1952 was 580 bbl.

Accumulative increased oil due to water flood is 197,216 bbl. The sand thickness averages 29 ft.

Phillips Petroleum's Beal Unit . . .

Before flooding, 95 bbl. per day
Present oil, 2,784 bbl. per day

PRESSURE PLANT . . . Design details at Phillips' new water-pressure plant and filtration units here are being inspected by members of the Kansas-Oklahoma water flooders' A.I.M.E. tour group.

Phillips Petroleum Co.'s Beal Unit water flood consists of seven leases totaling 1,040 acres in 21, 22, 27 and 28-23s-11e. At present 153 acres are being flooded. Development now in progress will place 220 additional acres under flood. Remaining potential waterflood acreage will then amount to 107 acres. All development is on the basis of 10-acre spacing for like wells.

Production on the Beal Unit is from the Bartlesville sand in Seeley-Wick pool of the Quincy trend. Average depth of the Bartlesville sand on the Beal Unit is 1,963 ft. Porosity averages 17.2 per cent and permeability averages 9.2 md.

Primary development of the leases took place in 1929-31. Production from the 545 primary acres amounted to 4,200,000 gross barrels or about 7,700 bbl. per acre.

Initial water flooding on the Beal Unit began in July 1950 with water being injected into four wells in a 40-acre pilot flood. The initial injection rate was 1,352 bbl. of water per day and oil production amounted to 95 bbl. per day. The first increase in oil production occurred in April 1952 when production for the unit was 114 bbl. per day. In February 1952 injection was commenced into 12 new input wells, thus increasing the developed acreage to 153.

All of the input wells except one converted well were drilled since water flooding commenced and were completed with 4½-in. casing cemented to the surface. The inputs were not shot on completion. No new oil wells have been drilled since water flooding commenced.

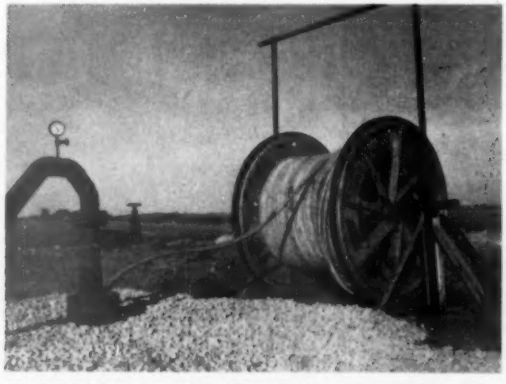
Water supply . . . Water for flooding was originally obtained from a supply well drilled to the Douglas sand. This source became inadequate in February 1952 when injection was commenced into the 12 new injection wells. At that time an Arbuckle water-supply well was placed in operation. This well is equipped with a 135-hp. Reda pump set at 843 ft. on 4-in. tubing.

Arbuckle water is mixed with produced water and the mixture is first aerated to remove iron, hydrogen sulfide, and carbon dioxide. Next, 1 lb. of lime per 10 bbl. of water is added by means of a chemical feeder-mixer. Effluent from the feeder-mixer goes to an asphalt-lined earthen pit where iron and excess carbonates settle out. The pit is designed to provide 3 days' settling time based on an anticipated maximum water volume of 25,000 bbl. per day. Present water volumes allow sufficient retention time so that no coagulent, such as alum, is needed. No algaecide is needed at present.

From the settling pit the water flows by gravity through four filter tanks containing anthrafilt as a filtering medium. The filter effluent goes into a 1,000-bbl. clear tank from which it is pumped into the formation by means of three Oilwell 46-P triplex pumps.

Pertinent figures for the Beal Unit as of September 1, 1952, are as follows:

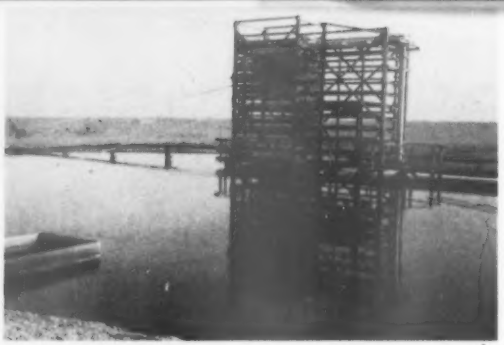
Oil production, bbl. per day	2,784
Water input, bbl. per day	9,570
Cumulative water-flood production, gross bbls.	345,674



WATER SUPPLY . . . This 135-hp. Reda pump currently is supplying over 10,000 bbl. per day of water to flood project in Seeley-Wick pool which ultimately will have 480 producing acres.

WATER-FLOOD PRODUCER . . . Unit pumper, Phillips Petroleum's Beal Unit water flood, Greenwood County, Kansas. Producing formation is Bartlesville, 1,965 ft. Some wells hit 350 bbl. per day.

75,000 BBL. OF WATER . . . This is final settling pond, before water goes to pressure plant and injection wells. Water elsewhere previously has been aerated and lime treated; in this pond the iron content and excess carbonates settle out during the 3 days' retention time.



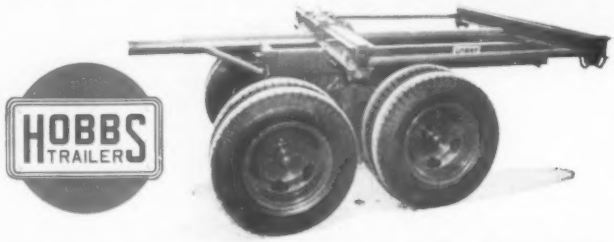
WATER AERATOR . . . Water for flooding, obtained from the Arbuckle limestone formation, is mixed with produced water and the mixture sprayed over this aerator, to remove iron, hydrogen sulfide, and carbon dioxide. Line to aerator is of large-diameter cement-asbestos pipe.

Cumulative water-flood production, bbl. per developed acre	2,259
Cumulative water input, bbl.	2,904,683
Cumulative water input, bbl. per developed acre	18,985
Acres developed	153
Acres responding to water flood	132.5
Number of active oil wells	59
Number of active water input wells	13

Development now in progress consists of 14 input wells to be drilled, 7 producers to be converted to input, and 1 new oil well to be drilled. Completion of this development will place 373 acres under flood and leave 107 acres yet to be developed.

RIG FLOOR . . . Another water-injection well about to be completed by Rig 39 of Phillips Petroleum Co. at work on Beal Unit water flood. Pay is the Bartlesville sand, 1,965 ft. deep, porosity 17.2 per cent, permeability 10 md.

HAUL 'EM with HOBBS



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How to Cope With Crooked-Hole Problems

Straighter holes usually result when using (1) large drill collars, which also increase penetration rate and bit footage, (2) two-cone bits, or (3) stabilized drill-collar strings.

by Gerald Burgess*

IN drilling the typical Rocky Mountain steep-dipping structures it is not surprising to find that some of the wells drilled prior to the advent of the straight-hole instrument were in excess of 30° at 4,000 ft. or less, and in completed oil wells of such type, each time the tubing is pulled it would be necessary to change several of the tubing couplings because of extreme wear.

In such a hole it is quite evident just what would take place on the inner wall of the casing while these tubing couplings were wearing, until there was less than 1/16 in. of stock left on one side. It was "natural" to replace a large portion of the casing in these wells from time to time in order to continue production.

On the other hand, benefits that may be realized from controlled drift can be illustrated by using another field area in which the wells were allowed to drift to a predetermined rate.† The wells drilled prior to the additional deviation allowance required 75 to 80 days' drilling time and 85 to 90 bits; the latter wells were drilled in only 32 to 35 days and used an average of only 40 bits!

In the process of drilling in another area it was decided to move the surface locations down-structure approximately 250 ft., and to allow the holes to deviate with a procedure similar to the one just described. Directional surveys were run at approximately 50-ft. intervals; however, no special trips were made in order to take a survey. The surveys were taken when a trip was made for a bit change. It was proved without a doubt that direction could be controlled to some extent by interchanging bit types, tricone to cross-section and vice versa. However, the amount of direction change seemed to be limited to about 45°.

There were some 200 bits used in the drilling of these wells, and after a careful check each time that the bit type was changed, it was noted that there was a definite change in direction. Drilling time was reduced from 42 days to 20 days; and the bits from 38 down to 21. Due to the fact that the objective sand was in a narrow oil ring it was not necessary to resort to deflection tools of any type in order to direct the bore to the proper point.

The two projects that have just been described heretofore were completed 15 years ago, and to date there have not been any producing problems of a serious nature, and the tubing and sucker-rod coupling wear is quite negligible.

There are a few cases where the deviation clause has been entirely eliminated from the drilling contract; however, in the Rocky Mountain region this is not true except in a proven area where a maximum angle can be predetermined; and these in relative shallow holes.

Personally it is believed that because of the wide range of formation dips drilled in this area, "0° to 90°," that both the operator and contractor should use extreme caution in their application of a decision as to whether or not the deviation clause should be eliminated from the drilling contract. It is my opinion, however, that operator and contractor could both benefit considerably by using the controlled drift method in preference to the present fixed-angle clause which now permits the drilling of a "dog leg hole" that may be a headache to both parties.

Considerable cooperation between the operator and contractor would be most essential, with a careful study of contour maps and well spacing programs. Perhaps in some instances it could be allowed, and would not be out of order, to move the surface location in order to obtain the desired point of production penetration.

Preventing Deviation

As to the methods for preventing hole deviation, or correcting same, certain items are briefed hereinafter:

One method (which will not meet with approval of some) . . . is the use of 8-in. o.d. by 3½-in. bore by 44-ft. drill collars, run in a 9-in. hole. In certain experiments with this procedure, the 8-in. o.d. and 6¼-in. o.d. collars were run intermittently with each bit change. It was discovered that where the large collars would allow 16,000 lb. of weight to be applied to the bit, the 6¼-in. collars would allow only 7,000 lb. before the bore would start to deviate. However, the results were that the penetration rate was increased 45 per cent, and the bit footage 30 per cent! We have used the large collars in the drilling of 11 wells. There were five collar failures. On one job it was necessary to make a second run for the fish. It should be understood, of course, that this procedure is followed in only extreme cases.

"Two-cone bits" . . . These have been used to a good advantage in keeping the well bore under control and to straighten the hole. However, in extremely hard abrasive sections this type of bit has a relatively short life.

"Peg-leg bits" (a standard tricone bit with the No. 2 cone cut off . . . These have been very effective in some formations. However, due to the erratic

The Author Says . . .

"THIS paper has been prepared in relation to Well Bore Deviation, to the possibility of eliminating the deviation clause from "Drilling Well Contracts," and to methods used in deviation control in the Rocky Mountain area.

"Before proceeding any further I believe we should analyze the term 'crooked hole.' Many of the wells drilled today do not exceed the contract specification of 5°, but could still be considered as crooked holes. On the other hand a well bore may have a deviation of 12° at 5,000 ft., and by using a carefully planned program this well could be a far better hole, from a producing or drilling standpoint, than the well with only a 5° deviation.

"Example of the statement just made: A recently drilled well was surveyed as being 4¾° at 965 ft.; 2¼°—2,160 ft.; 4¾°—2,275 ft.; 1¼°—2,560 ft.; 3¾°—2,995 ft.; 1°—3,285 ft.; 3°—3,475 ft.; 4¼°—3,780 ft.; 5°—4,420 ft. This hole had a negative deviation of 16½° to the total depth of 4,420 ft., and in my opinion this would certainly be considered a crooked hole. New drill pipe was used to drill the hole, and upon completion of the well the 6-in. o.d. tool joints were worn down to an average of 5¾-o.d."

*Ohio Oil Co., Casper, Wyo. Paper presented at twelfth annual meeting of American Association of Oilwell Drilling Contractors, Oklahoma City, September 28-30, 1952.

†Possibly 1° per 300 ft. of hole until a maximum deviation of 10° was reached, or until the bit had reached a point at which it would not deviate any further regardless of the amount of weight applied. Several of these holes seemed to reach a maximum point of deviation at about 8°. These wells were directionally surveyed and it was interesting to note that even though the drift was not directly up-structure, the direction of swing from a true up-structure line was practically the same in each well.

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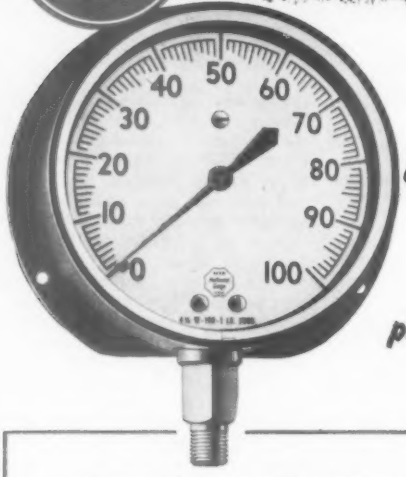

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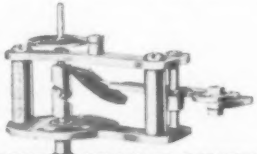

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performance of these bits it is rather difficult, in the over-all picture, to evaluate the benefits that may have been derived from them.

Stabilization of drill-collar strings . . . The procedure utilizes either the roller reamers dressed with flats, or wing stabilizers dressed to approximately ⅛ in. of the bore gage. Usually a stabilizer or reamer is run directly above the bit with at least two more spaced, at no more than 40-ft. intervals, above the bit. If small collars 6¼-in. o.d. or less are used, spiraled or wing stabilizers should be fabricated at one-half the interval of the stabilizers that have been installed at the drill collar joints.

Rat-hole method, used to straighten a hole, is to drill a rathole ahead for 30 ft. with a small bit, and then ream to full gage. This procedure is, of course, quite expensive and is used only when the angle reduction is an absolute necessity.

Rotary speeds . . . Considerable experimenting with rotary speeds in excess of 500 r.p.m. was tried by one operator without any apparent success from the deviation standpoint, but the penetration rates were increased to some extent. This procedure was discontinued after the drilling of two wells as the maintenance cost more than offset the gain of the penetration rates.

Summarization

In summarizing the foregoing discussion it is believed that the two most important questions that the contractor should check with the operator when preparing a bid to drill is as follows:

1. **What dip angle** do you anticipate you will penetrate?

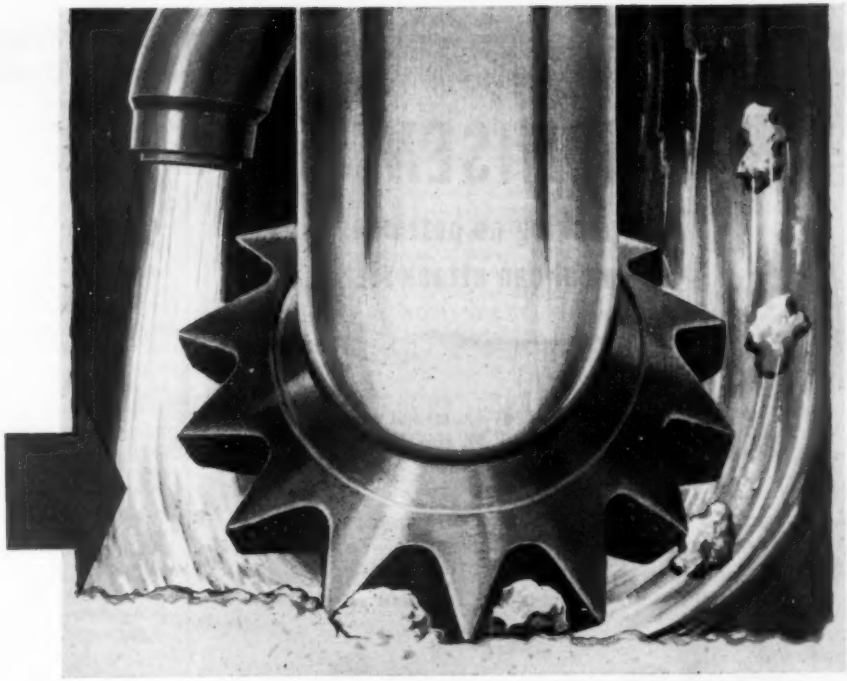
2. **Are there any known fault zones** in the immediate area of the location? By moving the rig one location dips may be increased from 10° to 35°. Actually the dip angle penetrated is the determining factor as to how rapid or far the hole will deviate from vertical.

Finally, if the rig is fortunate enough to get a location on the structure axis, a "swivel bail" hole can be anticipated! But moved to the steep side of the structure a difficult hole can be looked for.

BOOK

SELECTION AND USE OF ENGINE ANTIFREEZES. Published by American Society for Testing Materials, 1916 Race Street, Philadelphia. 16 pp. 40 cents.

This new publication provides consumers with practical information and advice on engine cooling-system antifreezes and corrosion inhibitors. Other cooling-system service products, such as cleaning compounds and stop-leaks, are also discussed.



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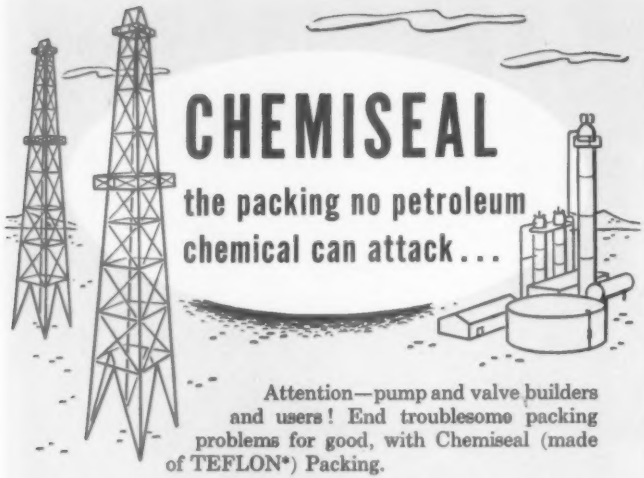

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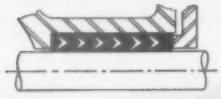

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Southern Natural Removes Distillate

(Continued from page 89)

into field gathering lines. During periods of low field quotas, gas velocities in the field lines coming into the plant are reduced to the extent that adequate contact is not maintained between the gas and the injected absorption oil.

Studies are now under way to correct this deficiency and it is possible that during periods of low quotas the gas could be automatically manifolded into one or two lines upstream from the injection nozzles and thus maintain the necessary higher gas velocities. Another method to improve recovery would be the installation of absorber vessels to replace the line injection process. However, it is doubtful that the additional recovery would justify the expense of the high-pressure absorber vessels.

Field tests indicated that at 15° F. and 300 psi. the untreated gas would drop about one-third of its liquid distillate content. At the higher quotas ranging over 250 M.M.c.f. per day, it has been found that the recovery is substantially higher and can be maintained by the injection of 500 gal. of lean oil per M.M.c.f., or twice as much as is required to eliminate drop-out in the pipe line. For oil rates in excess of 500 gal., little additional distillate is picked up.

A pilot plant was operated successfully and subsequently dismantled prior to construction of the present Gwinville distillate reduction plant on which construction started in November 1951.

Distillate Reduction Operations

Operation of distillate reduction commences in the field lines where semi-rich absorption oil is injected into them with specially constructed venturi-type nozzles at points 500 ft. upstream from the plant manifold. The field gathering system consists of two 8-in. and two 12-in. lines.

Absorption oil is pumped at 1,040 psi. Experiments were made with injection pressures as high as 1,500 psi. through special nozzles and high-head pumps and it was found that more distillate could be recovered at the high injection pressures; however, due to the necessity of putting this plant on stream at an early date, and due to the late delivery of high-pressure pumps, it was decided that injection would be made at the original designed pressure. Contact between the oil and gas is obtained by the combined flow through the gathering line.

Plant operations . . . Rich oil is with-

drawn at the first-stage two-compartment separator. Liquid water is also withdrawn from this separator.

A metered quantity of lean oil is mixed with gas from the first-stage separator and the mixture is separated in a scrubber battery from which gas goes to a dehydration plant, then to the pipe-line transmission system.

Semirich oil from the second-stage accumulator is pumped to the injection nozzles in the gathering lines. Two stages of separation provide countercurrent contacting between the oil and gas and also prevent dilution of the lean oil by liquid distillates contained in the raw gas.

Rich oil from the first-stage separator flows to a flash still which operates at 35 psi. Gases produced in this operation are used for plant fuel and the small excess over fuel requirements is presently vented. It is planned that this vented gas will be used for part of the fuel requirements of a main-line compressor station which is to be installed this year.

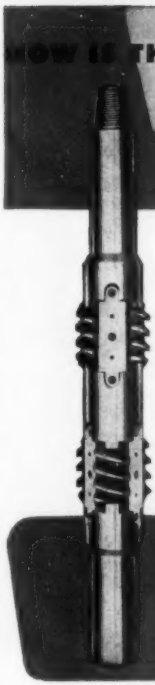
Liquid from the bottom tray of the flash still is pumped through a reboiler where it is heated to 320° F. Rich oil flows from the furnace to the rich-oil still. Stripping steam is fed to the rich-oil still and is measured by a flow recorder.

Absorption oil from the rich-oil still, after serving as the heat source for the flash-still reboiler, is cooled at 100° F. and run to storage. Since carbon and sludge tend to contaminate the absorption oil with continued use, it is processed to reduce this problem. Purification is accomplished by distilling a portion of the absorption oil stream.

Operating changes . . . Distillate reduction operations have been conducted according to original plans with two minor exceptions: (1) the rich-oil still has been operated at 30 psi. instead of 18 psi. as originally planned; (2) as a temporary expedient lean oil has been pumped direct to the injection nozzles on the field lines. But the standard method for the existing plant will continue to be injection of only semirich oil into the field lines.

It is expected that the design for the next distillate-reduction operations may be somewhat modified: Lean oil would be injected at high-pressure absorbers or directly into field lines; in the event the line injection method is used, there would be only one-stage separation, and from this separation, rich oil would go directly to flash still.

In the future, it is quite likely that absorption towers of an economical type would be incorporated in the design to increase the amounts of absorbed liquids.



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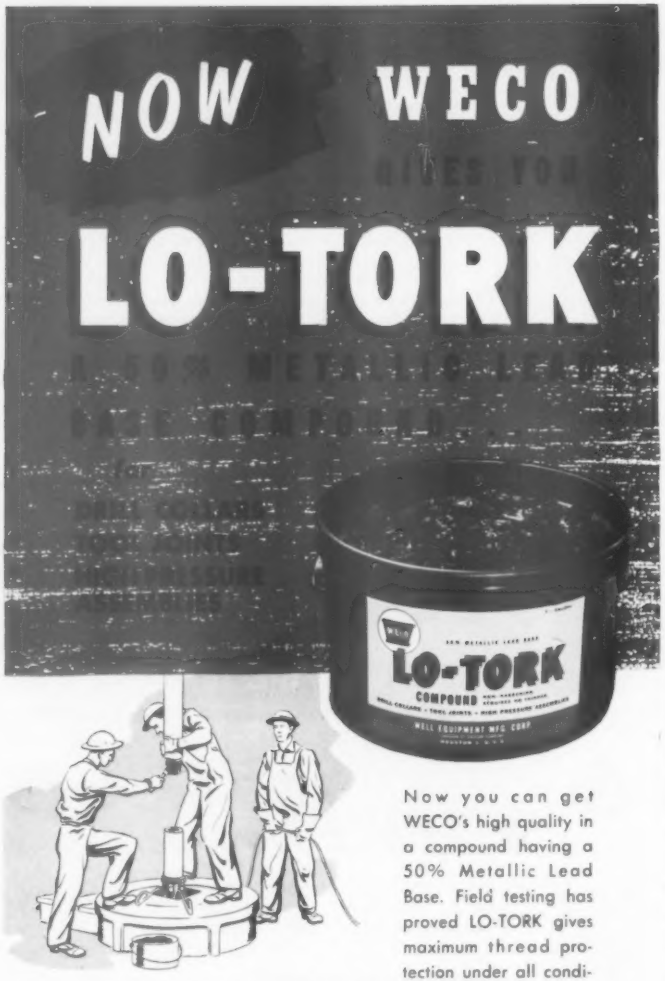

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BOOKS

OIL AND PETROLEUM YEARBOOK, 1952. Published by Walter E. Skinner, 20 Copthall Avenue, London, E.C. 2, England. $4 post free.

This edition includes up-to-date particulars concerning 800 companies operating in all parts of the world and covering all branches of the oil industry, together with a list of 512 managers and engineers and the companies in the book with which they are connected. The book contains information on the principal British, American, Canadian, and foreign companies. The data given include names of directors and other officials, description of business, where operating, crude-oil production, refinery runs, details of capital, dividends, and financial results. The Buyers' Guide of Manufacturers comprises 737 headings.

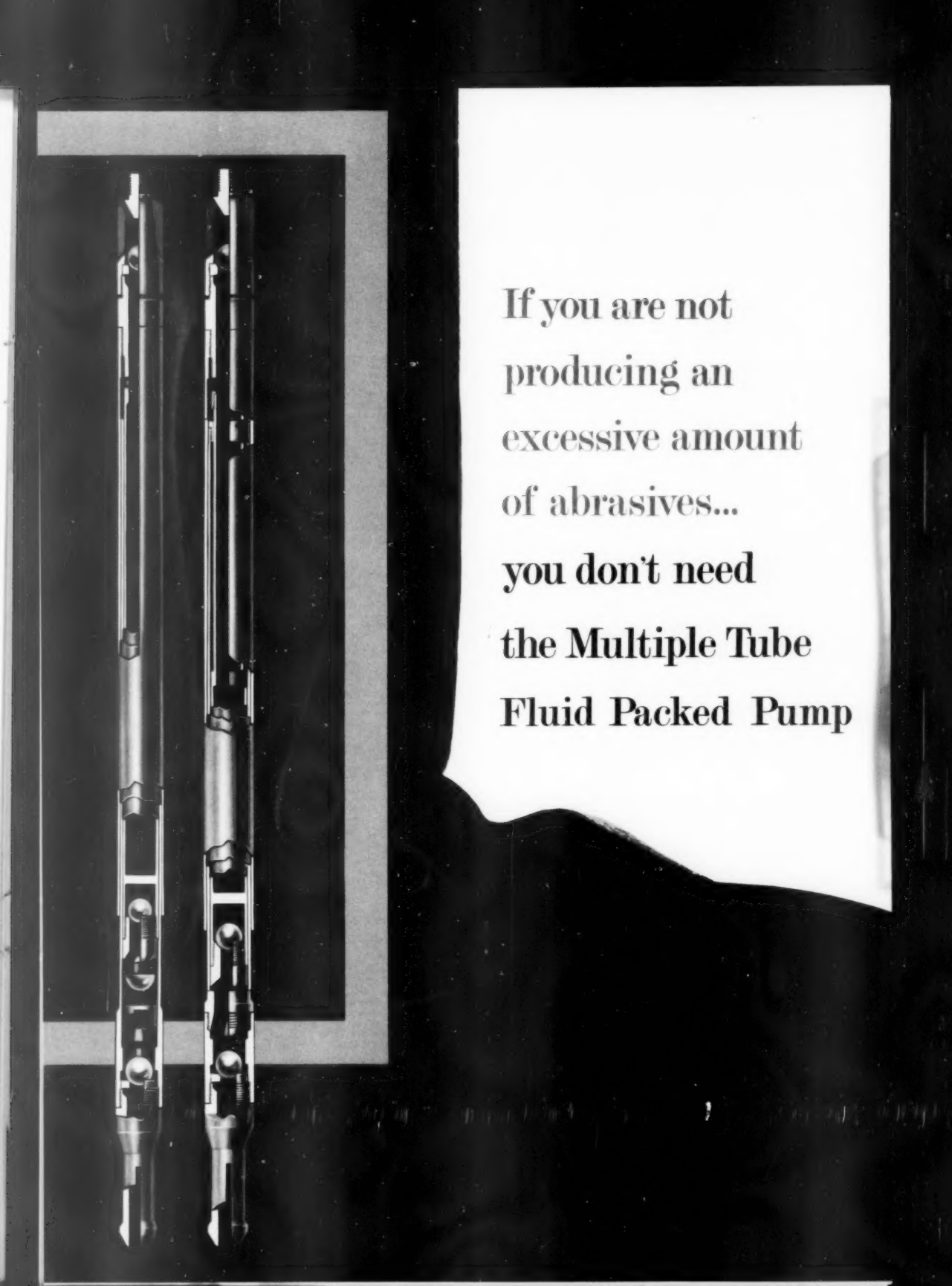
UNITIZED AND COOPERATIVE PROJECTS IN THE UNITED STATES. Published by the Interstate Oil Compact Commission, Box 3127, State Capitol, Oklahoma City. 78 pp.

This publication is a survey of unitized and cooperative-agreement projects which was prepared under the supervision of a joint committee from the Research and Coordinating Committee and the Secondary Recovery Advisory Committee of the I.O.O.C. with Tom Winfiele, chief engineer of the Louisiana Department of Conservation, as chairman. It contains the data reported to the committee on 173 unitized projects in 13 states and similar data on 23 cooperative agreement projects in 7 states. Included are 36 charts relative to reservoir performance or production and 10 maps showing the areas covered by individual projects.

TULSA GEOLOGICAL SOCIETY DIGEST, Volume XX. Published by Tulsa Geological Society, P. O. Box 263, Tulsa. 348 pp. $2.

More than 25 geological articles are carried in the 250 pages devoted to technical material in this volume. Included in the technical material are an article on the Williston basin, accompanied by maps; two papers on photogeology; several pool papers; three articles on electrical logging; and several articles on stratigraphy. Three geologic reports on Oklahoma include maps and sections. A membership list of the T.G.S. is appended.

"My partner's a little shy!"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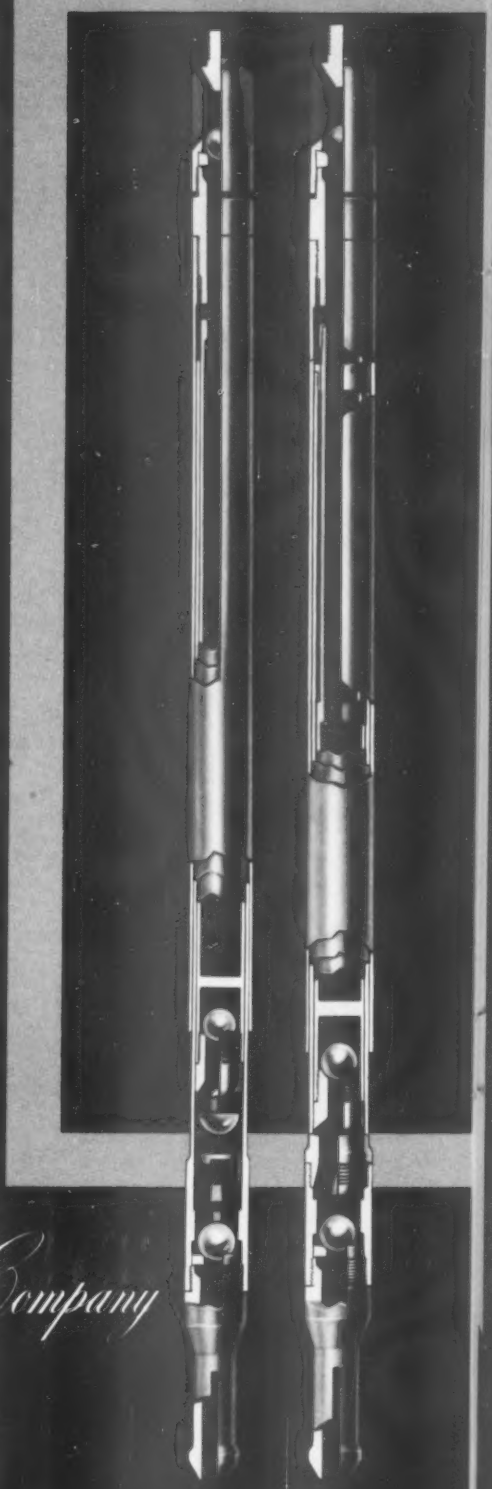

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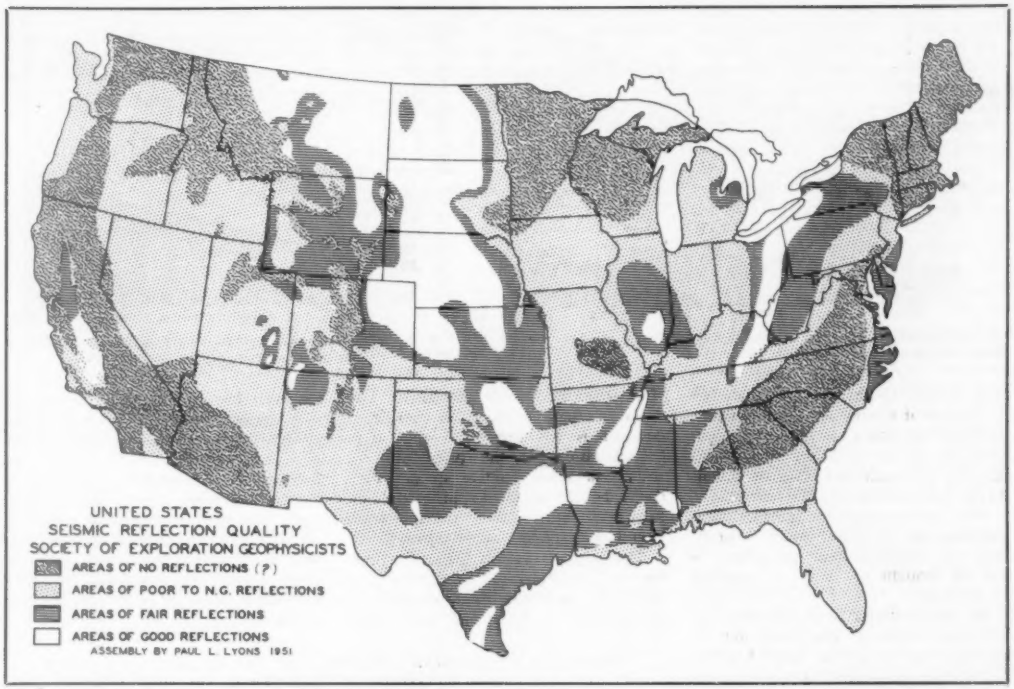
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AREAS OF FAIR REFLECTIONS
AREAS OF GOOD REFLECTIONS
ASSEMBLY BY PAUL L. LYONS 1951

Map indicating those areas where good seismic reflections are obtained and those areas where the generally used methods vary from clear to no reflection whatever. (Geophysics, July 1951.)

THE LONG-RANGE OUTLOOK

Where Will Tomorrow's Oil Come From?

"Granted continuation of reasonable economic incentives and adequate supplies of materials, crude oil and natural gas may be counted upon to be available in abundance for the foreseeable future."

by E. V. Murphee*

FROM available information it appears that there exists, both in the United States and the world, large amounts of oil that will be discovered in the future. These deposits should enable the world to meet its petroleum needs for a long time to come.

Due to the high rate of consumption in the United States, more difficulty can be expected in the United States' producing its own needs for petroleum than applies to the world as a whole. The prospects, however, for the United States to supply a major part of its own needs for crude petroleum are good, as there are very large areas which should contain oil that remain to be explored.

At some time in the future, it is expected that materials other than crude petroleum will gradually be used to supplement the manufacture of oil products. These alternate sources are plentiful in the United States. Hence, availability of oil products does not depend on the availability of crude petroleum. However, use of alternate sources will result in more expensive products.

*Standard Oil Development Co. Paper presented at Centennial of Engineering, Chicago, September 11-12, 1952.

Demand Increase

The production of crude petroleum and natural gas has increased with the general increase in energy demands of the United States and the world and has displaced other forms of energy. The accompanying tabulation shows the mineral energy production in terms of B.t.u.'s in the United States for 1900, 1925 and 1950.

Fig. 1 is a plot for various years of the total energy consumption of the United States, with an extrapolation up to 1965 based largely on Bureau of Mines estimates. It will be noted that the use of energy for transportation purposes is increasing at a very slow rate and it is expected to actually decline slightly from 1955 on. This de-

MINERAL ENERGY PRODUCTION IN THE UNITED STATES

	British thermal units—trillions				Per cent of total		
	Coal	Oil	Gas	Total	Coal	Oil	Gas
1900	7,020	369	254	7,643	91.9	4.8	3.3
1925	15,195	4,430	1,278	20,903	72.7	21.2	6.1
1950	14,542	11,438	6,583	32,563	44.7	35.1	20.2

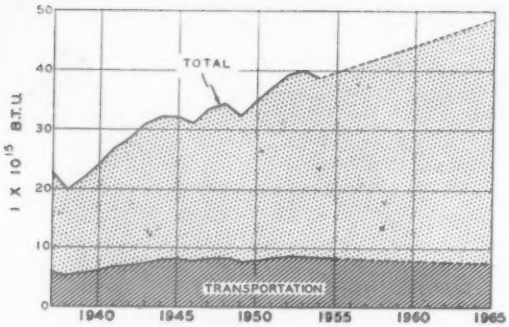

Fig. 1—Plot for various years of total energy consumption of the United States with an extrapolation up to 1965.

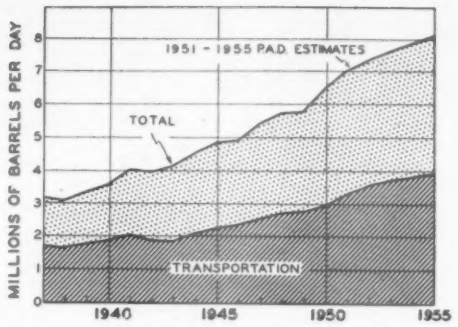

Fig. 2—Some past consumption of petroleum in the United States as well as estimated consumption through 1955.

cline is due to the greater efficiency in the use of energy for various transportation purposes, and most particularly due to use of diesel locomotives in place of much less efficient steam-driven locomotives on the railroads.

While total energy for transportation purposes may decrease, use of oil products for transportation purposes, as will be brought out later, is expected to increase.

One major factor in the expansion in petroleum demand has been the increasing use of oil for space heating, particularly in homes. In this field oil has, after making some allowance for the convenience of oil heat, taken markets from coal primarily on a cost basis. For example, at the present time on the eastern seaboard the cost of heating a home with oil is appreciably below that of the cost of heating it with coal. The point is that a large factor in the growth of the use of oil has been its low cost, all factors considered, relative to coal.

Demand Forecasts

The demand for oil products in the United States and throughout the world will undoubtedly continue to grow with a more rapid increase being likely outside the United States than within the United States. Some past history consumption of petroleum in the United States as well as estimated consumption through 1955 is given in Fig. 2.

A number of forecasts of future oil demands have been made. These have all been based on the assumption that the relative prices of fuels will bear about their present relationship. One such forecast prepared by the Bureau of Mines in 1950 for the United States indicates a 1965 consumption in the range of 7.7. to 9.1 millions of barrels per day. In its report of June 1952, the President's Materials Policy Commission estimated U. S. demands in 1975 as 13.7 millions of barrels per day. If the price relationships among fuels should change, this would in turn affect the demand for petroleum. The major increase pictured in petroleum demand is for purposes other than transportation. If the price of coal should decrease relative to oil, then the rate of expansion of petroleum for uses other than transportation would undoubtedly slow down.

The demand for oil for space heating in homes can be affected appreciably by technical developments that would tend to make the heat pump or solar heating more attractive. At the present time these two forms of home heating in general do not appear too attractive due to the relatively large capital investment involved. Atomic energy may affect the demand for oil products in the future, particularly for propulsion of ships and for production of electric power. The main product here affected would be residual fuel. It does not appear, however, at the present time, considering the technical problems to be overcome and the general world situation (military considerations may restrict the use of atomic energy) that the effect of atomic energy on the demand for oil products will be appreciable over the next 10 to 15 years.

Future Supplies of Petroleum

The Committee on Oil and Gas Availability of the National Petroleum Council has made a very thorough study of future availability of petroleum on both a short and a long-range basis. The information it has prepared has been drawn on freely in this paper.

A reasonably definite picture can be given of the short-range supply situation on petroleum. The Committee on Oil and Gas Availability presented a forecast through 1955, which indicated that supplies should be adequate for demand. The results of this survey, along with information on 1951 consumption and estimates of 1955 consumption, are given in the following tabulation:

PROJECTED AVAILABILITY, 1951-1955, FOR ALL PETROLEUM LIQUIDS
(Thousands barrels daily)

		Excluding Russian dominated areas	
	U. S.	Foreign	Total
January 1951—			
Production	6,465	4,498	10,963
Availability	7,300	4,703	12,003
Consumption	7,032	4,245	11,277
1955 availability range—			
Lower	7,789	6,669	14,458
Upper	8,838	7,427	16,265
Estimated consumption	8,300	5,500	13,800

It will be noted that for the United States availability in 1955 is expected to range somewhere between 7,800,000 and 8,800,000 bbl. per day. The demand for 1955 is expected to be slightly over 8 million barrels per day. With a moderate increase in net imports, now amounting to about 400,000 bbl. per day, there should be a fair margin of availability over demand. For the world, excluding Russian dominated areas, supplies appear adequate.

Abundance predicted . . . All long-range forecasts that have been made in the past, with which the writer is familiar, have turned out to be so low as to be meaningless when examined a few years later. The National Petroleum Council Committee wisely refrained from making any quantitative predictions on long-range availability of petroleum. They did, however, come up with the following conclusion:

"Available supplies of oil and gas in the United States and the world are greater than ever before and are still

increasing rapidly. Granted continuation of reasonable economic incentives and adequate supplies of materials, crude oil and natural gas may be counted upon to be available in abundance for the foreseeable future."

Bases for Prediction

I think you would be interested in considering the reasons the above conclusion was reached. You will note in Fig. 3, which is a chart showing U. S.

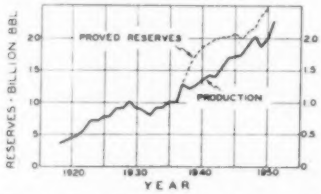

Fig. 3—Chart showing United States crude oil reserves since 1918.

crude oil reserves for the various years from 1918 through 1951, that proven reserves have increased steadily through the years, and that the increase in crude reserves has been in step with annual production.

Reserve picture . . . It will also be noted that proven reserves have been consistently more than 10 times the annual production rate. Proven reserves represent working inventory and are not in any sense indicative of how much oil there may be in the ground that will be discovered later. Proven reserves are constantly decreased by withdrawals and added to by new discoveries, extensions and revisions of previous estimates.

Compared to many other mineral extraction industries, the working inventory maintained by the petroleum industry is high. Present proven reserves of crude oil and natural gas liquids in the United States are about 32 billion barrels.

Information on reserves of crude oil and natural gas liquids outside the United States is not as detailed or as accurate as within the United States. Present estimates indicate proven reserves outside the United States and exclusive of Russia to be in the neighborhood of 75 billion barrels. The present rate of production outside the United States is running at the rate of 1.8 billion barrels per year, so that the ratio of proven reserves divided by yearly production outside the United States is 41.

Considering the world as a whole, therefore, the proven reserves are 107 billion barrels, which represents about 25 times the yearly production. It is felt that in the foreseeable future there is no cause for concern in regard to oil supplies for the world as a whole, excluding Russia and other iron curtain countries, provided there is free movement of oil. The question does remain as to how dependent the United States may wish to be on foreign oil supplies from a national defense standpoint. The problem for the foreseeable future on oil supplies is therefore concerned with the United States.

Turning then in particular to the United States, past history indicates that the oil industry has done a good job. They have met demand and have been able to maintain their prices at a level where the use of oil has been attractive compared to other fuels.

Success ratios . . . Future availability is frequently approached on the basis that each field discovered reduces possibilities for future discoveries. Some people feel that due to the large amount of oil discovered in the United States the rate of discovery is bound to soon fall off. It is interesting to look at the facts. Fig. 4 is a plot for 1950 by states of the number of exploratory wells drilled which found oil or gas as compared to the total number of exploratory wells drilled.

The states involved include old producing areas and new producing areas. It will be seen that the points for the various states and Canada fall fairly well along a straight line, indicating the success ratio is reasonably constant irrespective of whether the areas are old or new. In Canada where exploratory drilling is largely in a new highly prospective area there is no indication the success ratio is any different than in the states shown in this country. The only conclusion we can reach from this chart is that in all the states involved, and in Canada, new discoveries are in direct proportion to exploratory effort.

Another interesting fact can be brought out by considering Fig. 5 in which, for the period 1948-1950, new oil including discoveries, extensions and revisions are plotted against the exploratory footage drilled for various states. Here again the points do not fall too far from a straight line, indicating that new oil is proportioned to exploratory effort. The areas covered are both old and new prospective areas. There is no evidence that old producing states respond less to exploratory effort than new producing states.

Untested areas . . . While each new discovery may mean one less field to discover, it should be remembered that each new discovery adds to the knowledge of the petroleum industry and may lead to discovering new fields more

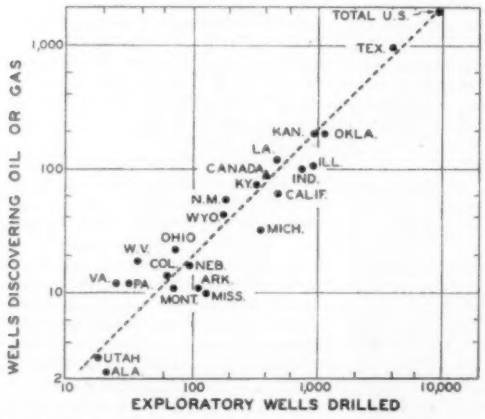

Fig. 4—Plot for 1950 by states of number of successful exploratory wells drilled as compared to total exploratory tests drilled.

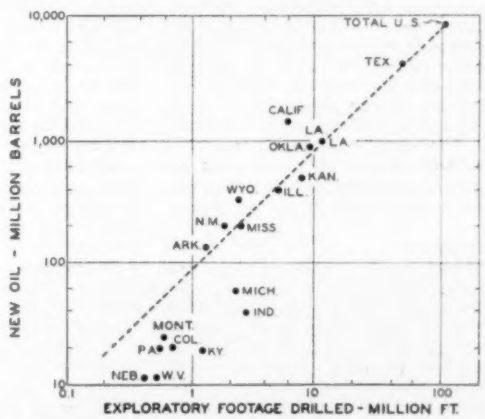

Fig. 5—New oil, including discoveries, extensions, and revisions plotted against exploratory footage drilled for various states.

rapidly or discovering fields which would not have been discovered without the knowledge that had been obtained. Very often new discoveries lead to new geologic concepts on accumulation of oil, which is extremely valuable for making future discoveries.

Most of the drilling to date has been in relatively shallow formations and was stopped at the first important producing formation found. Only subsequently in general have deeper formations been looked at and this has frequently resulted in the discovery of additional producing horizons. To date, the major quantities of oil have been discovered at depths less than 5,000 ft. As of January 1950, only about 600 exploratory wells had been drilled to depths of more than 12,000 ft.

In a large part of the prospective area the sediments in which petroleum deposits may occur extend deeper than 15,000 ft. At the present rate of exploratory drilling of around 10,000 wells per year, it would take over 100 years to drill one exploratory well in each square mile of the prospective area.

Outside the United States there are vast deposits of oil in the Middle East, Latin America and undoubtedly in Canada. New discoveries in these areas are made with only a fraction as much exploratory effort as in the United States. The prospective area outside the United States is at least 10-fold greater than that in the United States.

Petroleum Technology

There is no direct method of finding oil. Through experience the occurrence of oil is associated with certain types of geologic structures or traps, and the types of structures that the occurrence of oil may be associated with increase with experience.

In general, oil is found through a process of initial exploration using the best technical methods available at the time to determine locations where drilling is felt may be most successful. In areas that are known to be productive, one out of nine exploratory wells on the average turns out to be successful.

Technology is constantly improving methods of exploration. The most important exploration tools before drilling are based on geology and geophysics.

Geophysics . . . In the field of geophysics the most important tool is the reflection seismograph. With this method the time it takes for an explosion wave to travel down to a formation where it will be reflected and back up again is measured. There have been many improvements made in seismograph instrumentation and in the methods of presenting and interpreting the records obtained, with the result that more accurate overall results have become available.

One of the problems experienced in applying the seismic method is that in many areas of the United States adequate reflections are not obtained. Accompanying is a map of United States indicating those areas where good seismic reflections are obtained and those areas where the seismic reflections by generally used methods vary from clear to no reflection whatever. It will be noted that in a large part of the total area of the United States the reflections are poor to unstable.

Much of the present work on the seismic method is concerned with extending the areas in which reflections may be obtained, and substantial progress is being made. This will enable extension of the areas in which underground structures can be determined and will naturally be of great assistance in the future for discovery of oil.

In applying geology in oil exploration it is important to know whether there are rocks in a prospective area which have been a source of oil. Positive knowledge that a formation has been a source of oil is just as important in indicating the possible presence of petroleum as an oil seep. Real progress is being made in postive identification of source rocks and this in turn will greatly aid the exploration process.

Drilling . . . Some advances have been made over the years in drilling technique which have resulted in reducing drilling costs per foot and enabling wells to go to much greater depths. Improvements in drilling technique have allowed more wells to be drilled for a given expenditure and consequently have enabled the exploratory effort to be extended.

Improvements in drilling, so far as depths that wells can be drilled, are brought out in Fig. 6, which is a chart showing the deepest well drilled for different years, and also the deepest producing depth. This chart in addition contains information on the average depth of all wells. It will be noted that the depth of the deepest well has steadily increased over the years and this of course is a reflection of the improvement made in drilling technique.

One recent development of interest in drilling has been the better use of the energy of the mud stream used in rotary drilling. So-called jet bits have been developed which have made a real advance in the speed of drilling in soft formations. In such formations the use of jet bits has resulted on the average in doubling the drilling rate. So far application of this method to the hard formations has not resulted in as great an increase in drilling rate as is obtained with soft formations but the increase is nevertheless substantial.

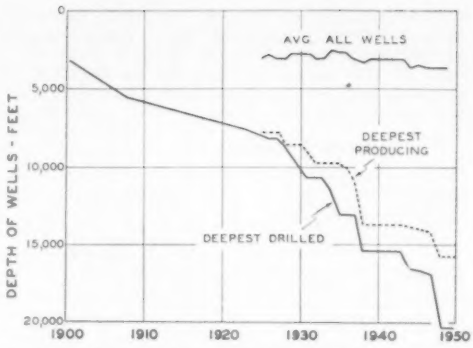

Fig. 6—Chart showing deepest well drilled for different years, and also deepest producing depth.

Reservoir studies . . . Over the years through research there has been obtained a better understanding of the performance of oil reservoirs and of the spacing required for individual wells to obtain full recovery of oil.

Over the period of 1859 to 1925, 700,000 wells were drilled which produced 8.7 billion barrels of oil and created 4.5 billion barrels of reserves, making a total of 13 billion barrels. Over the period 1926 to 1951, roughly the same number of wells, 696,000, were drilled.

These wells produced 34.5 billion barrels of oil and in addition created 21.5 billion barrels of reserves, making a total of at least 56 billion barrels. Over the latter 26-year period more than four times as much oil was developed as in the preceding 67 years, although the number of wells drilled was approximately the same for the two periods.

The reduction in the number of wells per unit of oil discovered in the latter period was primarily due to a better knowledge of desirable well spacing that came about through research. As a consequence the expenditures for a given oil production were greatly reduced and this in turn made more money available for finding and producing new oil.

Knowledge of reservoir behavior in addition to decreasing the number of wells to produce a given field has led to a better understanding of how to govern the operations of oil reservoirs

so as to obtain the most economic recovery. It is know that if the production rate is too rapid, excess gas may be lost from the reservoir which in turn means that less oil will be recovered. Too rapid a rate of production may also result in water fingering into the producing formation, resulting in low recovery.

It has been conservatively estimated that the knowledge that has been gained through research on reservoirs has increased oil recovery at least 25 per cent without consideration of secondary-recovery methods. In addition, research on reservoirs has led to developing of knowledge that can be used by state regulatory bodies in governing the production rate of different fields and this information has been put in simple enough form where its principles can be understood by that portion of the public that is concerned with crude oil production. As a consequence, waste in oil production has been greatly reduced and many of the states have adopted sound conservation practices.

Secondary recovery . . . After the primary production state, oil still remains in the producing formation and further production may be obtained by the application of a secondary recovery. The possibilities in this field are large. In 1950 it was estimated that the total oil in place in known fields at the time of discovery was 175 billion barrels. Primary recovery is expected to produce about 64 billion barrels of this oil and to this should be added about 4 billion barrels that may be obtained by conventional secondary-recovery methods, such as water flooding. This makes a total expected recovery of 68 billion barrels, or roughly 40 per cent of the oil in place.

There remains an estimated 107 billion barrels of oil that are susceptible to the application of improved recovery methods. This is a very large amount of oil and there is indication that secondary-recovery methods will be developed in the future that will be able to recover the bulk of this remaining oil. This will not only make a large amount of additional oil available from known discoveries but will increase the amount of oil that can be obtained from future discoveries.

Economics

The indicated existence of large quantitives of oil under the earth in the United States and the technical advances that have been and will be made in methods of finding and producing oil reservoirs, together with the possibilities indicated for greater recovery by improved secondary-recovery methods, will not in themselves produce the

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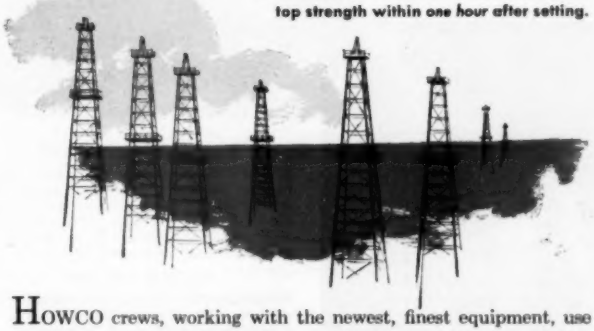

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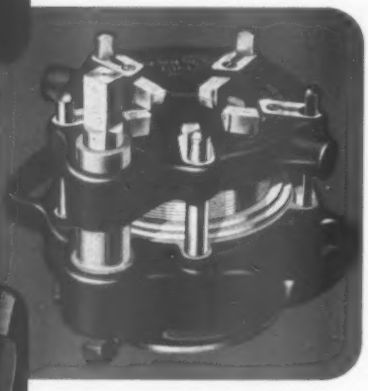

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quantity of oil that will be required. There must be an economic incentive.

The rate of discovery of oil primarily depends on the capital available for carrying out the effort to find it.

Other Sources

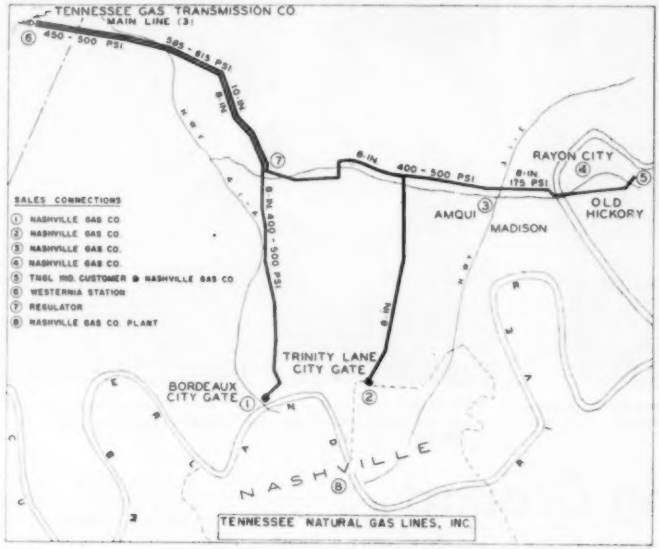
Oil products can be created from many other materials, the most promising of which are oil shale, tar sands and coal.

Oil shales . . . Production from oil shale at the present looks most promising. Rich oil shale in the Green River formation in Colorado is indicated to yield at least 100 billion barrels of oil and it is likely that the working of less rich deposits might bring this total up to 500 billion barrels, although at higher cost.

Studies recently completed by the National Petroleum Council indicate that this production of oil products from rich oil shale may be relatively attractive for the future although the cost of the products will be somewhat higher than those from petroleum at present prices. The industry may therefore well turn at sometime in the future to utilization of these oil shale deposits to augment supplies of oil products. The Athabaska tar sands in Canada represent a very large reserve of material from which oil products can be produced. It has been estimated these deposits will yield somewhere between 100 and 250 billion barrels of oil.

Coal . . . The United States contains large deposits of coal although there is some difference of opinion as to how much of these coal deposits can economically be worked for production of synthetic fuels. In any case, there is a large amount of coal that could be converted into oil products, if the need should arise. Two processes have so far been developed for conversion of coal to oil. One is the high pressure hydrogenation process and the other the Fischer-Tropsch process. Studies have been completed by the National Petroleum Council on the cost of production of oil products by higher pressure coal hydrogenation where the primary purpose is to produce oil products and not chemicals.

The indicated investment for oil producing capacity for this process is quite high, as is the cost of production. From these studies it appears that the general use of coal for production of liquid fuels by high pressure hydrogenation may be a considerable distance in the future and it is likely the use of oil shale will come first. The Fischer-Tropsch process may be a more attractive means of converting coal into oil products than high-pressure hydrogenation.



System map of Tennessee Natural Gas Lines, Inc., a 40-mile system.

Control of Outlet Regulators

. . . On Tennessee Natural Gas Lines

Dwight H. Woods*

INCREASE of pressure at one of the two city gates is accomplished by remote control through the use of a telemetering circuit used in the operation of the natural-gas system delivering to Nashville, Tenn.

Tennessee Natural Gas Lines, Inc., has a comparatively small pipe-line system in the matter of its total length; however, it has rather peculiar operating conditions. Due to its small size, it has no operating personnel, and its operation is managed by the personnel of its wholly owned subsidiary, Nashville Gas Co.

Tennessee Natural Gas Lines has a total mileage of approximately 40 miles of 8 and 10 in., pipe, as shown in the accompanying sketch.

Line operation . . . It receives its gas at point (6), the Westernia station, and delivers it to Nashville Gas Co. through Bordeaux station (1), Trinity Lane station (2), Amqui station (3), Rayon City station, (4) and Old Hickory station (5). Gas is also delivered to some 20 odd farm taps on the original 8-in. line between Westernia and Bordeaux stations. Inasmuch as it was desirable to keep the pressure to these farm taps as low as possible, and still deliver sufficient gas through the Bordeaux station regulator, the company installed a regulator at Westernia station (6), which cut the pressure to approximately 450 psi. from the Tennessee Gas Transmission tap to the Trinity Lane, Amqui, Old Hickory, and Rayon City stations.

It was not felt necessary to have full line pressure of Tennessee Gas Transmission on the whole of this new main system, therefore, a regulator at (7) was installed across a main-line valve so that at the present time pressure on the outlet side of (7) has to drop to 400 psi. before regulator (7) starts to feed gas into the line to Bordeaux, Trinity Lane, and Old Hickory stations.

During the extreme winter months, the regulators at Westernia and at (7) were each raised 50 psi. above the figures given, and prior to extremely cold mornings where the temperature is to be 10° or less, the main-line valve (7) is partially cracked to aid the regulator at this point.

At Amqui (3), the pressure is cut to 175 psi. because this line is in county highway right-of-way, and the company did not desire transmission-line pressures under this paved road.

In supplying the city of Nashville proper, which is done through Bordeaux station (1) and the Trinity Lane station (2) which feed into each end of a belt line around the city, the pressure is cut from line pressure to a metering pressure of approximately 160 psi., and then cut to pressures which vary between 75 and 125 psi.

There are installed at these two city gate stations, Bristol telemetering equipment which register at Nashville Gas Co.'s plant (8) the inlet pressure to the station, the outlet pressure from the station, and a telemetric orifice meter which registers at the plant accumulative purchases for each hour.

Telemetering . . . On two of the telemetering circuits which are on the outlet pressure there is a control system which enables the operator at the gas plant to change the settings of the outlet regulators at the city gate stations. Inasmuch as considerable electrical and lightning trouble has been experienced on the power and telephone circuits, it was necessary to install on these regulator control circuits a time delay system.

This operates in such a way that if the dispatcher at the plant presses a key requiring a regulator at one of the two city gate stations to increase pressure and holds the key for longer than 6 seconds, the motor changing the pressure at the city gate station stops at the end of 6 seconds, which represents approximately an increase of 2 psi. of pressure—then, before the pressure can be raised again, the operator has to return the key to the neutral position, then back to the raised position where it will work for another 6 seconds. This means in case of shortage or power failure that the regulator cannot move over 2 lb. before the damage is corrected. We have found this limiting factor to be a saving grace under peak-load conditions.

*Engineer, Tennessee Natural Gas Lines, Inc., Nashville, Tenn.

"TORTURE RACK" operated by E. O. Roe determines abrasion resistance of plastic cable covers in subzero temperatures while moving around a series of pulley sheaves.

TUMBLING BOX operated by L. M. Denton puts geophone through rough-and-tumble experiment that simulates days wear under field conditions in only an hour.

Seismic Proving Ground

Laboratory experiments put parts through tough service conditions, find weak spots, and prevent future failures

Joseph A. Kornfeld

WHEN a vital item of seismic equipment fails in the field, the entire crew bogs down. Work comes to a halt until the necessary replacement part can be brought to the scene of operations. Where crews work in isolated areas, far away from a handy supply of spare parts, a shutdown of this kind causes costly delays to contractor or company conducting survey.

Since it is both impracticable and expensive to carry a complete set of replacement parts, the best way to avoid equipment failures is to select items of the highest performance ability, particularly those prone to early failure. Past performance records by items serve a useful purpose in pinpointing those parts subject to frequent replacement. However, it is impossible to keep complete service-life records on every item to determine their respective life expectancy. Moreover, an item which would perform properly and show a long service life under normal climatic conditions might fail when subjected to Arctic cold or desert heat.

Carter Oil Co.'s geophysical department recognizes the value of prevention of equipment failures. Carter turned over to the company's research laboratory in Tulsa the problem of pretesting and preproving individual items which they know are prone to break down.

Value of proving ground . . . Conditions of accelerated wear are imposed artificially on various critical items of seismic equipment. These are brought about by laboratory experiments designed for special test conditions. Years of wear in the field can be compressed into a few hours in the laboratory by use of ingenious testing equipment.

Temperature extremes, too, are imposed on these parts. A combination of physical conditions are brought to bear simultaneously to bring to light quickly metallurgical or machining causes of failures. Defects in design show up rapidly under these stepped-up service conditions.

"Torture-rack" . . . Cable covers used by seismic crews must stand up under extremes of temperature. They must remain flexible in icy cold and desert heat. In normal use they must show high resistance to abrasion.

Things happen when a cable cover is subjected to Arctic temperatures such as are found in actual field operations in Alberta, Canada. Changes in composition by the manufacturer, such as addition of a small amount of carbon to the plastic cover, can affect the cable's reaction to severe cold weather. Under such conditions, the plastic cable may fly to pieces when handled. If this happened in the field, a complete seismic crew would be tied up for many costly days.

To conduct tests on items like the cable cover, Carter devised a "torture rack." In this insulated chamber box, the plastic cable moves along a circuitous route over many pulley sheaves set various angles. The temperature of the box is —80° F. a condition brought about by placing 100 lb. of dry ice in this closed chamber. The behavior of this plastic cover as it winds its devious route on an endless circuit throughout this research ice-box is studied by engineers through a removable side panel. Cables made by various manufacturers can be compared for endurance qualities and recommendations made to the purchasing department by the geophysicists.

"Tumble-box" . . . Geophones are inherently sensitive and delicate instruments. Weak points are pointed up quickly by a laboratory experiment which duplicates in 30 minutes what requires usually days under actual field conditions.

This is done by placing the geophone in a "tumbling-box" shown. This box is a small wooden chamber mounted on a horizontal axle rotated by an electric motor driving through a gear-box. When the geophone breaks, the instrument is taken apart to see which part broke first. Then Carter engineers know what part to strengthen. Laboratory reports document precise conditions and afford valuable data on which to make equipment replacements and to improve or revamp parts.

By preproving parts, these engineers prevent delays and insure greater continuity in the exploration performance of company seismic crews in the field.

How to Connect Into a Full Line Without Losing any Oil

W. R. Hart*

THE problem of connecting new tankage to a 12-in. bunker oil line with the least interruption of its use and with as little loss of oil as possible was solved by the method described here. The job done without the loss of any oil.

The line to be connected was over a mile long between valves and lay on a sandy surface in a country where summer temperature of 115° F. in the shade is not uncommon. The new line came in at an angle of about 35° and ended in a valve on a concrete support, about 15 ft. from the intersection.

*Westinghouse International, Cairo, Egypt.

A line was stretched perpendicular to the flange of, and from the center of the valve to the main line to determine the exact meeting angle. The top of the main line was then marked at the meeting point of the two center lines. Next a Y-piece was made to the required angle, with flanges on the through section. This length, plus allowance for a new main line valve was carefully laid out on the main line with proper reference to the intersection of center lines. (Figs. 1 and 2.)

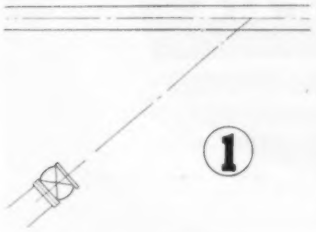
Back of the valve on the new line, a hole was burned out of the top of the line, a 4-in. coupling welded in, and a flange was bolted to the face of the valve. A drum was cut in halves with the halves dug in under the intended cuts on the main line to catch the drip. A small gas-engine-driven pump was set up with hose to reach the drum halves and the 4-in. coupling. Skids and chain blocks were rigged and operations started for cutting the line.

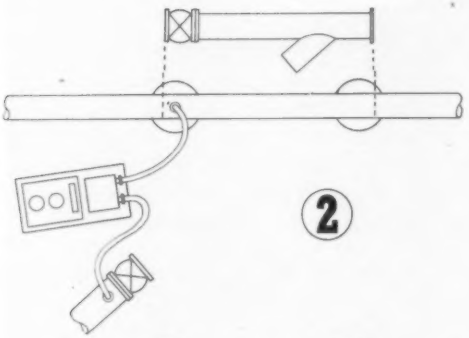
Valves on the main line were closed at 5 p.m. and cutting of the line started at midnight. This was to take advantage of a reduction in pressure in the line but before the maximum contraction in length of the line. A 5-in. circle was scribed on top of the line near one end of the section to be removed. On this circle ¾-in. holes were drilled as close together as possible and the intervening metal chipped out.

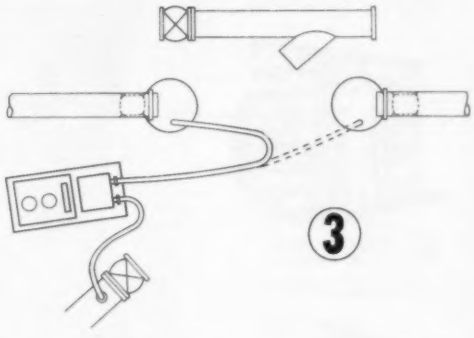
When the top of the pipe was open the pump hose was inserted. An estimated 15 tons of oil were pumped into the new line before the hose started sucking air. A chain pipe cutter was used on the line and as soon as the section was removed there was a moderate but steady flow from the line into the drum halves. This oil was pumped into the new line. (Fig. 3.)

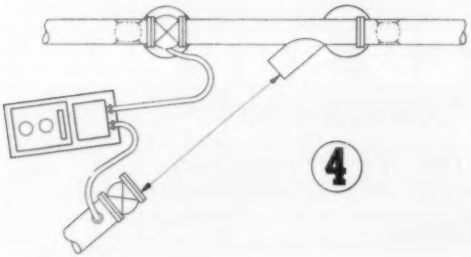
Two pieces of soft stone that had been chipped to a loose fit were slipped into each open end about 10 inches and the clearance sealed up with clay. After the exposed ends were cleaned, flanges were slipped over them and the new Y-piece and valve were lowered into place and bolted together and to the loose flanges. The flanges were then tack welded to the main-line ends and the valve and Y removed. (Fig. 4.)

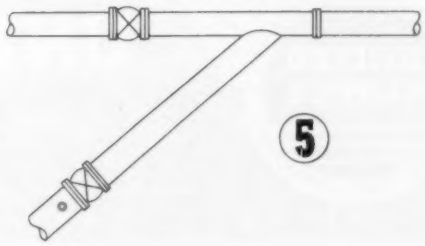
The flanges were welded inside and out, the clay and stones removed, and the valve and Y put back into place and bolted up permanently. The connecting piece to the new line was fitted and welded in and service resumed on the main line. Fig. 5 shows the finished job.











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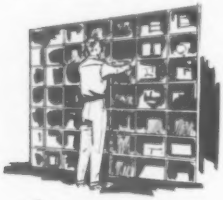

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THE JOURNAL'S WEEKLY
Engineering Reference
SECTION
No. 28

FANS AND BLOWERS:

Part 9—Friction Losses in Ducts and Elbows

by M. Van Winkle*

Viscosity of gas mixtures . . . No simple relation for calculating the viscosity of gas mixture from viscosities of the pure components has been devised. There are two methods available which involve considerable calculation. One[1] enables computing viscosity of a mixture from diffusivity data. The other[2] uses viscosities of the components to determine the viscosity of the mixture.

Commonly, viscosity of the mixture is estimated as the weighted average of the viscosities of the components. This is not too reliable and may in some instances be considerably in error.

Friction losses in ducts . . . There are several methods of calculating pressure drop in ducts caused by frictional losses. Unfortunately, roughness of varying degrees is present in most ducts, both rectangular and round, and this roughness has a major effect on frictional losses. The two methods given here are what might be called the "estimation method" and the "idealized" method.

The estimation method involves the evaluation of duct roughness as a "good" duct or "rough" duct.

For a "good" duct:

$$p_{fd} = p_v \text{ for } L = 70\ D_e$$

For a "rough" duct:

$$p_{fd} = p_v \text{ for } L = 40\ D_e$$

The diameters are equivalent round pipe diameters or hydraulic diameters. The L is the length of duct in feet through which the gas friction pressure drop will be equivalent to one velocity pressure.

Friction drop may also be calculated by an "idealized" equation:[3]

$$p_{fd} = [0.00540 + 0.397/(Re)^{0.3}] \times (L\rho v^2/2D_H g)\ (5.2)$$

*Professor of chemical engineering, University of Texas.

Where p_{fd} = friction pressure drop, in. H_2O, $Re = D_H v\rho/\mu = D_H G/\mu$ = Reynolds number, L = length of duct in feet, D_H = hydraulic diameter of duct in feet, v = average velocity, feet per second, ρ = density, pounds per cubic foot, g = gravitational constant, and μ = viscosity (absolute in) pounds per foot per second.

Note: $D_H = 4R_H$; $R_H = A/L_w$

Where D_H = hydraulic diameter, feet, R_H = hydraulic radius, feet, A = cross-sectional area of duct, square feet, and L_w = wetted perimeter, in feet.

Charts are available,[4] computed from the above relations, for standard air relating pressure drop in round ducts with volume of flow and duct diameter. Also charts are available for correcting this pressure drop to equivalent rectangular shapes.

Friction losses in elbows . . . For simple elbows friction losses can be calculated from data given in Table 1. Curve ratio and aspect ratio are illustrated by Fig. 1.

The equivalent length of duct is determined for each elbow in the duct system and the sum of these lengths is added to L in the p_{fd} evaluation.

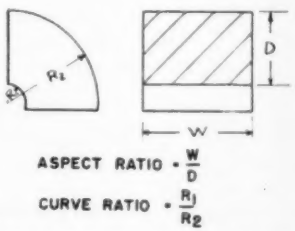


Fig. 1—Illustrating aspect ratio and curve ratio.

TABLE 1—DIAMETERS OF STRAIGHT ROUND DUCT EQUIVALENT TO ELBOW

	Curve ratio			
Aspect ratio—	0.2	0.333	0.5	0.66
Round duct:				
1	21	13	9	6
Rect. duct:				
4	13	8	6	6
2	17	10	8	7
1	18	10	8	7
0.5	24	14	9	9
0.25	30	19	14	14

For vaned elbows it is necessary to consult the manufacturers' data to determine pressure drop.

Discharge loss to atmosphere . . . When a fan exhausts to the atmosphere the velocity pressure of the discharge is loss. Therefore, a pressure loss equivalent to the discharge velocity pressure must be added into the p_f terms to complete the total pressure loss.

Total frictional losses . . . The total frictional losses are:

$$p_f = p_{fe} + p_{fc} + p_{fd} + p_{fo}$$

Where p_f = total frictional pressure losses in conduit system, in. H_2O, p_{fe} = expansion pressure losses, in. H_2O, p_{fc} = contraction or entrance pressure losses, in. H_2O, p_{fd} = frictional pressure losses in duct, in. H_2O, and p_{fo} = discharge or exit velocity pressure losa, in. H_2O.

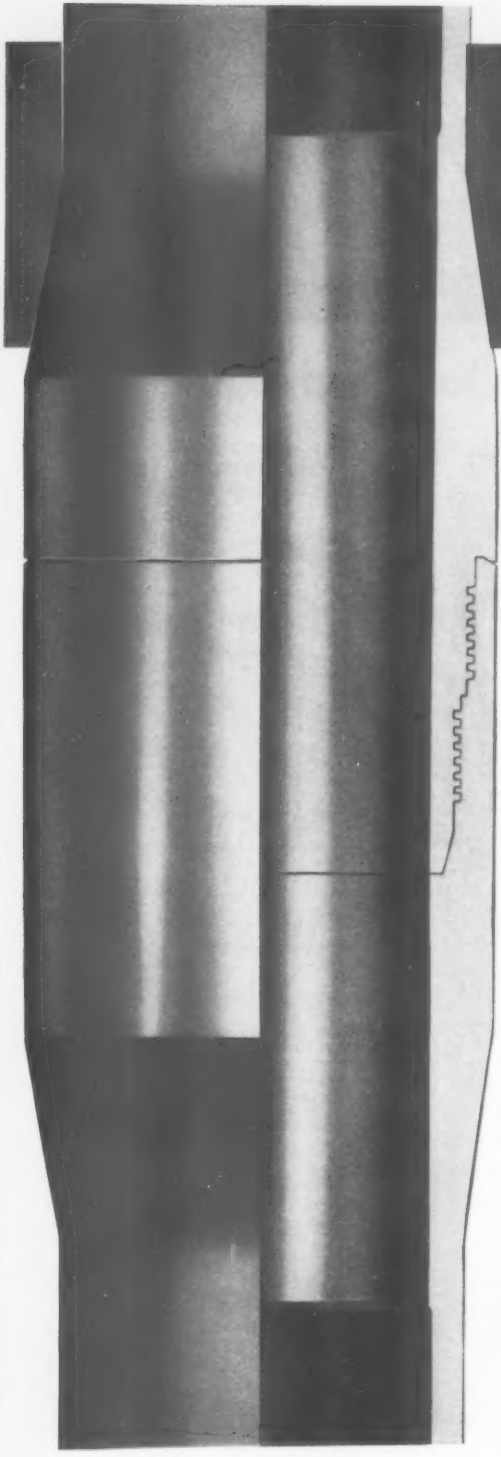
References

1. Buddenberg and Wilke, Ind. Eng. Chem. 41, 1345 (1949).

2. Wilke, C. R., Jour. Chem. Physics, 18, 517 (1950).

3. Durand, W. F., Aerodynamic Theory, Vol. 3, p. 138.

4. Sturtevant Condensed Engineering Data Catalog No. 500, B. F. Sturtevant Co., Hyde Park, Boston, Mass.



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MODERN DRILLING

1.—How To Get More Service From Industrial Hose

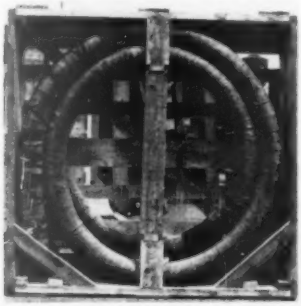
by J. A. Muller*

THE first step in getting the most from your industrial hose is to select the correct hose for the job. Many users give very little thought to selecting hose, buying mainly on price. It is not realized, for example, that there are many special types of hose for special applications in many industries.

The standard rubber hose consists of an inner tube, a carcass of fabric or cord and a cover. The composition of the rubber of the inner tube determines what material can be carried. The kind and the thickness (number of plies) of the carcass limits the pressures the hose can stand. The cover is designed to withstand the various working conditions encountered in industry.

Tube . . . Significant advances in rubber chemistry have greatly enlarged the usefulness of hose. Rubber in the tubes can now be compounded to resist attack by oil, butane, propane, acetylene, insecticides, paints, lacquers, mild acids and a host of other chemicals. Hoses are in use for carrying dry and wet solids as well as gases and liquids. Abrasion resistance is built into the tubes of such material handling hose.

*Executive engineer, Thermoid Company, Trenton, N. J.



CARE OF RUBBER HOSE should begin as it is uncrated at the plant.

Hose for carrying steam, hot water or other hot liquids also have heat-resistance incorporated in the rubber of the tube.

Carcass . . . The simplest rubber hose consists of rubber only and is generally used to carry water or air at low pressures. In the simple hose, the tube, carcass and cover are all one. When a hose must carry gases or liquids under pressure, a simple tube is not enough. So reinforcement of cotton, rayon, nylon, steel, is wound or braided around the tube. The higher the pressure, the more reinforcement is required. In cases of extremely high temperatures of the material being carried or of the working environment, asbestos may be incorporated in the carcass.

The carcass also enables the hose to withstand excessive deformation under service conditions.

Cover . . . The carcass must be protected from moisture, abrasion, oil, impacts and sun-light by a cover. The cover also helps identify the hose and makes for better appearance. What is true of rubber compounds available for tubes is also true for covers. Many more compounding ingredients are available today than a few years ago. Better resistance to wear, petroleum products, sunlight and cuts can now be built into the cover. In some cases wire reinforcement is interwoven in the carcass to prevent collapse of the hose instead of for burst-resistance. This type of hose is used mainly in unloading liquids such as fuel oil from trucks. The hose is carried on a reel from which the hose is unwound to reach the tank. The hose is almost never completely unwound. The pressure of many layers of hose on the reel would flatten the hose making passage of liquids difficult or impossible unless the hose were reinforced to hold its round shape under all conditions.

Couplings . . . Although not a component of hose, couplings are an important part of any hose system. Many types are available for general and specific uses, made from several kinds of metals. In high-pressure applications, the couplings become the most critical factor. It is easy enough to design a hose to take pressures as high as 5,000 psi. by using enough steel wire reinforcement and enough rubber. The problem is to bond the hose to the coupling. Thermoid has solved this particular coupling problem by a patented design in which the steel wire reinforcement is attached positively and mechanically to the coupling. This is used in the oil fields in rotary pressure seal hose.

RUBBER HOSE is valuable for any number of things around a drilling rig.

Part 10 of a series

by Dr. B. E. Lauer, Head, Department of Chemical Engineering, University of Colorado

h_f HEAT TRANSFER

COEFFICIENT of HEAT TRANSFER through FILM between WARM PARALLEL FLAT SURFACES and COOL GAS

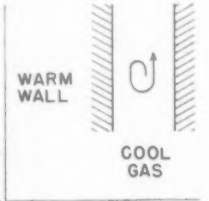


Plate Position: Vertical

Gas Movement: Natural Convection

EQUATION:

$$h_f = 0.116\, k \left[\frac{\rho^2 \beta\, \Delta t\, g}{\mu^2}\right]^{\frac{1}{3}}$$

TERMINOLOGY:

h_f - Film coefficient of heat transfer, BTU/hr.sq.ft.$^{\circ}$F.

k - Thermal conductivity of gas at t_f, BTU/hr. ft.^{2} $^{\circ}$F./ft.

ρ - Density of the gas at t_f, lb./cu. ft.

g - Acceleration of gravity. 4.17×10^8 ft./hr.^{2}

β - Coefficient of volumetric expansion of gas at t_f; for ideal gas is equal to $1/^{\circ}$R. (cu. ft./cu.ft.)/$^{\circ}$F.

Δt - Temperature difference between wall and gas, $^{\circ}$F.

μ - Viscosity of gas t_f, lb./ft. hr.

C - Specific heat of gas at constant pressure, BTU/lb.$^{\circ}$F.

t_f - Film temperature, assumed as arithmetic average of wall temperature and bulk gas temperature, $^{\circ}$F.

LIMITATIONS:

This equation can be used on the assumption that gases obey perfect gas laws, $pV = nT$.

SIMPLIFIED EQUATIONS: When the plates are more than 20 mm. apart, the heat transfer by free convection between air and plates can be obtained by the following:

(a) vertical plates, more than 1 ft. high

$$h = 0.27\, (\Delta t)^{0.25}$$

(b) vertical plates, less than 1 ft. high

$$h = 0.28\, \frac{\Delta t}{L}^{0.25}$$

SOURCES OF DATA: For physical constants for use in above equation see Chemical Engineers' Handbook - J. H. Perry, (1948).

for ρ -- see pp. 130-148, 175-195, 1582.
μ -- see pp. 370-374, 1198, 1696.
β -- see pp. 200-202.
k -- see pp. 459-461, 1303, 1697.
C -- see pp. 225-235, 297, 1588, 1696.

REFERENCES:

1. Applied Heat Transmission, J. H. Stoever, p. 60 (1941).
2. Heat Transmission, W. H. McAdams, pp. 241-242.
3. Colburn & Hougen, Ind. & Engr. Chem., Vol 22, p. 522, (1930).

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COEFFICIENT of HEAT TRANSFER through FILM between WARM PARALLEL FLAT SURFACES and COOL LIQUID

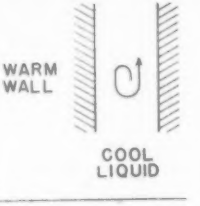


Plate Position: Vertical

Liquid Movement: Natural Convection.

EQUATION:

$$h_f = 0.128 \left[\frac{k^2 \rho^2 C \beta g \Delta t}{\mu}\right]^{\frac{1}{3}}$$

TERMINOLOGY:

h_f - Film coefficient of heat transfer, BTU/hr.sq.ft.$^{\circ}$F.

k - Thermal conductivity of liquid at t_f, BTU/hr. sq. ft. $^{\circ}$F./ft.

ρ - Density of liquid at t_f, lb./cu. ft.

g - Acceleration of gravity. 4.17×10^8 ft./hr.^{2}

β - Coefficient of volumetric expansion of liquid at t_f.

Δt - Temperature difference between wall and liquid, $^{\circ}$F.

μ - Viscosity of liquid at t_f, lb./ft. hr.

C - Specific heat of liquid at constant pressure in BTU/lb. $^{\circ}$F.

t_f - Film temperature, assumed as arithmetic average of wall temperature and bulk liquid temperature, $^{\circ}$F.

PHYSICAL CONSTANTS: The values of the physical constants such as density, viscosity and others are reported in the International Critical Tables, in several handbooks, and in the technical literature.

Volume and page references in the International Critical Tables are as follows:

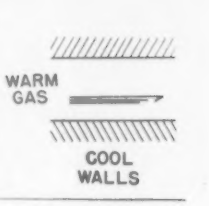
for ρ -- Organic liquids I, 176-280; Gases III, 3-29; Liquids III, 28-43; Solutions III, 81-198; Refrigerating solutions II, 327; Glues II, 218; Oils, fats and waxes II, 209; Liquid fuels II, 136-166; Gaseous fuels II, 166-167.
μ -- Gases V, 1-6; Liquids V, 10-12; Solutions V, 12-25; Fluidity - 14,-V, 25-52; Refrigerating solutions II, 328; Glues II, 220; Oils, fats and waxes II, 209; Liquid fuels II, 136-166.
β -- Gases III, 3-29; Liquids III, 439-440; Solids III, 81-198; Liquid metals II, 463; Refrigerating solutions II, 327; Oils, fats and waxes II, 210; Liquid fuels II, 144.
k -- Gases V, 213-215; Liquids V, 226-229.
C -- Gases V, 79-84; Elements V, 92-94; Liquid chemical compounds V, 106-113; Pure liquids V, 112-115; Solutions V, 115-117, and V, 112-129; Refrigerating solutions II, 328; Oils, fats and waxes II, 210.

References:

Colburn & Hougen, Ind. & Engr. Chem., Vol. 22, p. 522, (1930).

C 5 a

COEFFICIENT of HEAT TRANSFER through FILM between COOL PARALLEL FLAT SURFACES and WARM GAS



Position of Plates: Horizontal

Gas Movement: Streamline Flow

EQUATION:

$$h_f = 1.65 \left[\frac{k}{2d}\right] \left[\frac{VpC}{kL}\right]^{\frac{1}{3}}$$

TERMINOLOGY:

h_f - Individual coefficient of heat transfer, BTU/hr. sq. ft. $^{\circ}$F.

k - Thermal conductivity, BTU/hr. sq. ft. $^{\circ}$F./ft.

d - Distance between plates, in ft.

V - Velocity, ft./hr.

ρ - Density, lbs./cu. ft.

C - Specific heat at constant pressure, BTU/lb. $^{\circ}$F.

L - Length of plates in direction of flow, in feet.

LIMITATIONS:

This equation applies only to streamline flow with Reynolds number less than 2100, with a parabolic velocity distribution and the absence of free convection currents. The term (VpC/kL) must be greater than 10.

SOURCES OF DATA:

For physical constants for use in above equation see Chemical Engineers' Handbook - J. H. Perry (1948).

for ρ -- see pp. 130-148, 175-195, 1582.
μ -- see pp. 370-374, 1198, 1696.
β -- see pp. 200-202.
k -- see pp. 459-461, 1303, 1697.
C -- see pp. 225-235, 297, 1588, 1696.

REFERENCES:

1. A. P. Colburn, Trans. Amer. Inst. Chem. Engr., 29, 174-210, (1933).

2. Kirkbride and McCabe, Ind. Eng. Chem. 23, 625-631, (1931).

D 1 b

No. 143

REFINER'S NOTEBOOK

ELECTRICAL INSTALLATIONS—3

Explosionproof Equipment

by B. Z. Segall*

THE flat surfaces, in the type of equipment mentioned in the preceding installment, must be machined to a very high degree of accuracy to control the width of the space between the two flat surfaces. (This width will vary from about 0.002 to 0.0045 in. depending upon the size of the enclosure). The width of this opening and the length of the flanges must be accurately designed to close tolerances to provide a "proper flame path." A proper flame path is provided when the hot exploded gases entering this extremely small opening between the two flanged parts are cooled by the metal flanges to a safe temperature. This cooling is accomplished through heat absorption by the metal flanges as the hot gases pass over the flat surfaces of the flanges. (Fig. 1).

Threaded construction . . . The second type of construction employes threaded joints. At least five full threads are required to be fully engaged between the threaded parts of the enclosure. Fig. 2 shows a junction fitting which is typical of this thread joint construction.

The flame path in this case is around the threads. Here again, sufficient metal is provided to cool the hot exploded gases as they escape from within the enclosure to the outside atmosphere. (Fig. 3).

*Consulting engineer, New Orleans.

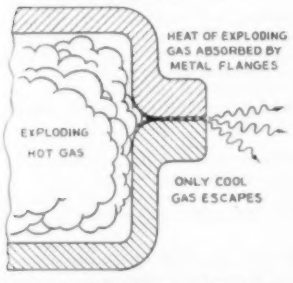


Fig. 1—Showing how flanged joints prevent escape of flames.

Flat and Threaded Joint Compared

In general, the threaded type of construction is somewhat superior to the flat-joint construction. The flat surfaces may become scratched or dented and then will permit the passage of flames to the outside atmosphere from within the enclosure. These fittings, therefore, must be handled rather carefully to avoid damage to the joint surfaces.

It is most important that the flat joint cover screws be kept tight. It can be easily demonstrated that if only one screw is not completely drawn up, flame may be permitted to pass from within the enclosure to the outside atmosphere.

Threaded joints, inherently, will have a much better flame path for comparable types of fittings. Therefore, they will not require a very high degree of fit.

It should be noted that the explosion pressure tends to restrict further the flame path in the threaded joint in that this explosion pressure tends to close the space between the threaded surfaces. In the flat joint this pressure tends to separate the surfaces.

At present, only one piece of equipment is available for Class I, Group A Hazardous Installations. This is a lighting fixture manufactured by Safe Lighting, Inc. The fixture itself is designed for operation with air pressure in the lamp chamber. This unit, incidentally, is approved for Groups B, C, and D Hazardous Locations.

Some additional fittings, materials, and apparatus are available for Group B installations. There is not, however, a complete line of electrical equipment for this group of Hazardous Locations.

For Groups C and D there is practically a complete line of fittings, materials, equipment, and apparatus available. Class I electrical installations for these Groups may be completely expedited with the electrical equipment which is presently approved and which can at present be purchased from many manufacturers of such equipment.

Electrical fittings and other equipment approved for installation in all classes of Hazardous Locations are usually labeled to show the approval for its respective class and group of location. The labels at present do not show approval for a Division 1 or a Division 2 location. In the next installment a classification of Division 1 and Division 2 locations will be discussed.

Labels are provided by testing laboratories, such as the U. S. Bureau of Mines, Underwriters' Laboratories, Inc., and even some state testing laboratories, after such equipment has been subjected to standardized tests and found to be acceptable by these laboratories.

Lists are also available showing these approvals. Underwriters' Laboratories, Inc. "Hazardous Location Electrical Equipment List" (the red book), is the generally accepted listing for this equipment. This list shows all the acceptable equipment, fittings, etc., available for Class I, II, and III Hazardous Locations.

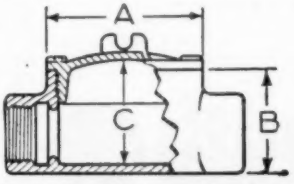


Fig. 2—Typical fitting employing threaded joint construction. (Crouse Hinds Co.)

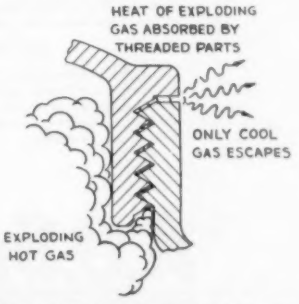


Fig. 3—Showing how threaded joints prevent escape of flames.

IMPORTANT DATA FOR WELDING ROD PURCHASERS

WELD-O-GRAM

SUPPLIED BY A. O. SMITH FOR IMMEDIATE RELEASE

IN COMPETITIVE TESTS RADIOGRAPHS OF 50,000 WELDED JOINTS IN CROSS COUNTRY PIPE LINE PROVE SW-80 ELECTRODE CUTS REJECTS IN HALF

Made by the world's largest manufacturer of transmission line pipe and casing.

SW-80

A new, E-7010 Electrode for field welding of line pipe. Just one electrode for stringer, hot, filler and finish passes. Same strength throughout. Easy to manipulate. Deposited weld metal is superior in strength and ductility.

HERE'S THE STORY...

Radiographic inspection of 50,000 joints was made during construction of a major transmission main.

One-fourth of the inspected welds were made with the A. O. Smith SW-80 rod. Rejections were only 1%. Rejections among the rest of the welds made with competitive rods were *more than* 2%.

In other words more than twice as many joints welded with competing rods were rejected as compared with those welded with the SW-80.

If all joints had been welded with the A. O. Smith pipe line electrode, rejects would have been cut by 500. This could conceivably yield a saving that would more than repay total expenditures for electrodes used on the entire pipe line comprising approximately 200,000 joints.

No wonder the new SW-80 electrode is gaining acceptance all along the line!

Write for free pocket-size electrode handbook.

A. O. Smith Corporation, Dept. OG-1152
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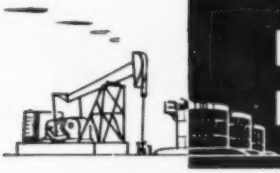
Made by welders . . . for welders



by
Ralph F. Nielsen

Back-Pressure Method for Measuring Capacity of Gas Wells

THE "open flow capacity" of a gas well can now be determined by the Bureau of Mines Back-Pressure Method.

According to Darcy's law the isothermal steady state flow of an ideal gas through a porous medium is given by

$$Q = C(P_r^2 - P_s^2)$$

where
- Q = rate in standard cu. ft. per unit time
- P_r = shut-in formation pressure
- P_s = sand face pressure under flowing conditions

The back-pressure method makes use of a plot of Q against $P_r^2 - P_s^2$ to extrapolate the flow rate to that which would be obtained if the well were discharging to atmospheric pressure. A plot of Q against the quantity in parentheses should, according to the formula, give a straight line on ordinary graph paper and a 45° line on log paper. Actually it has been found that a straight line is obtained on log paper but not, in general, with a 45° slope, so that the formula becomes

$$Q = C(P_r^2 - P_s^2)^n$$

where n is less than unity. The departure of the exponent from unity may be due to such things as lack of strictly isothermal and viscous flow near the well bore, where pressure gradients are high.

The determination of P_r, the shut-in formation pressure, requires that the well be shut in long enough to assure stable conditions. If a bottom-hole gage is not used the following relation may be used:

$$P_r = P_w e^m; \quad m = \frac{Gh}{53.3\,ZT}$$

where
- P_w = the static well-head pressure
- G = gravity of gas compared to air
- h = vertical depth in feet
- Z = supercompressibility factor
- T = logarithmic mean temperature in °R.

The sand face pressure P_s under flowing conditions may be calculated from the following relation, based on Weymuth's formula for vertical flow:

$$P_s^2 = e^{2m} P^2 + (e^{2m} - 1) \times \frac{(QZT)^2}{4.6 \times 10^{10}\, d^{5.33} \cos x}$$

where
- P = well-head pressure for Q std. cu. ft. per day
- d = tubing (casing) diameter in inches
- x = angle of deviation from vertical

Steady conditions must be obtained for each measurement.

A calculation illustrating the method is based on the following data:

P	Q
1,493	18.5 MM
1,468	26 MM
1,405	39 MM

G = 0.62, d = 6.456, h = 5,200 cos x = 1, Z = 0.78 (flowing), Z = 0.82 (static), T = 540 (flowing), T = 565 (static), P_w = 1,550. Making the proper substitutions,

$$m \text{ (static)} = 0.62 \times 5{,}200/53.3 \times 0.82 \times 565 = 0.131$$

$$P_r^2 = 1{,}550^2\, e^{.262} = 3{,}133{,}000$$

$$m \text{ (flowing)} = 0.62 \times 5{,}200/53.3 \times 0.78 \times 540 = 0.143 \text{ and } e^{.286} = 1.332$$

$$P_s^2 = 1.332\, P^2 + \frac{0.332\, Q^2 \times 0.78^2 \times 540^2}{4.6 \times 10^{10} \times 6.456^{5.33}} = 1.332\, P^2 + 6 \times 10^{-11}\, Q^2$$

This gives

Q	P_s^2	$P_r^2 - P_s^2$
18.5×10^6	2,998,000	135,000
26×10^6	2,904,000	229,000
39×10^6	2,724,000	409,000

When the last column is plotted against Q (Fig. 1), a nearly straight line is obtained. Extrapolation to P_s = 15 or $P_r^2 - P_s^2$ = 3,133,000 gives the "absolute" open flow as 155 M.M. cu. ft. per day. This is the theoretical flow if the sand-face pressure could be maintained atmospheric, and is therefore a measure of the flow capacity independent of the size of tubing or casing.

If it is desired to find the steadied flow through 3½-in. tubing (d = 3.55) as a function of the well-head pressure. The coefficient of Q in the last equation is multiplied by $(6.456/3.55)^{5.33}$ giving

$$P_s^2 = 1.332\, P^2 + 1.4 \times 10^{-9}\, Q^2$$

For each of several values of Q, $P_r^2 - P_s^2$ and hence P_s^2 is obtained from Fig. 1, whence P is calculated from the equation. A plot of the flow through 3½-in. tubing against well head pressure P is shown in Fig. 2, the "open flow" being about 45 M.M.

Among the complicating factors in the use of the back-pressure method is the presence of liquid in the well bore. If this cannot be blown out, graphical or algebraic expedients to allow for it must be tried.[1]

Reference

1. Rawlins and Schellhardt, Back-Pressure Data on Natural-Gas Wells, U. S. Bureau of Mines Monograph 7.

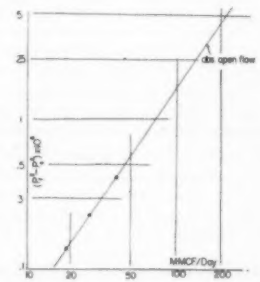


Fig. 1—Determining "absolute open flow" by extrapolation to atmospheric sand face pressure.

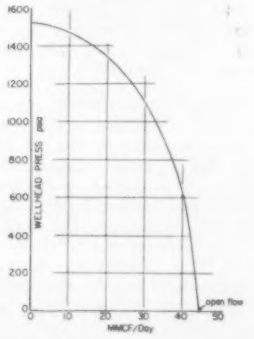


Fig. 2—Flow through string of 3½-in. tubing as a function of a well-head pressure.

*Associate professor, petroleum and natural-gas engineering, Pennsylvania State College.

PROGRESS IN METALS

by W. L. Nelson
Technical Editor

Eliminating Rolling-Mill Defects

DEFECTS such as pipes and blowholes, banded structures and inclusions, and flakes tend to arise during melting operations. In addition, defects caused by faulty heating, overlapping, the rolling in of foreign substances, defective fixtures, or the use of damaged or ill-functioning rolls, can arise during rolling operations. The elimination of defects were discussed in detail in an abstract by C. A. Liedholm in the March issue of Metals Progress.

Faulty heating . . . The forging cross often appears when the deformation has been conducted below A_1 and is the result of great stress concentration in the diagonal planes. Further rolling often leads to cracks in the core of the section.

Grain growth and Widmanstatten structure will result from too high a rolling temperature. The steel may become very brittle.

Temperature of the material should be measured after the first pass when the scale has been broken off. Long bars should be tested from end to end because excessive temperature variations can cause variations in grain size along the entire bar. Overheated steel, which has developed coarse grain and Widmanstatten structure, can often be restored through subsequent annealing but burned steel is beyond repair. Burning occurs only after excessive decarburization.

Overlapping . . . This may result from poor adjustment of the rolls or excessive spreading due to low rolling temperature, causing the steel to enter the space between the rolls and form fins which cool faster than the body of the section. If the profile is edged in the next pass the fin is pushed into the material, eventually causing overlapping which appears as "seams" on two longitudinal faces of the section.

This condition may be recognized by the appearance of the segregation zones on a cross-section of the material. The surface zone may be displaced locally, enough to bare the center zone which sometimes lacks sufficient plasticity to be deformed under such conditions. It may be subject to cracking because of sulfur and phosphorus segregations, although it can be deformed without trouble as long as it remains completely embedded in the sounder surface material.

A condition resembling overlapping can arise when superficial blowholes are opened during rolling as a result of the scaling away of the material layers which originally protected them from contact with the furnace atmosphere. If no decarburization has occurred in the defects one can usually conclude that they were due to blowholes rather than to overlapping.

Rolled-in foreign material . . . This may consist of small scraps that accidentally enter the furnace, weld to the ingot surface, and remain undetected under the scale. Consequently, such scraps will then be rolled into the section to form a perfect weld that is hard to detect. Even nonmetallic matter such as brick fragments may bake into the hot ingot surface and may damage the rolls as well as the surface of the bars if not discovered in time.

Defective fixtures . . . Scratches from guides and guards arise easily if their contact surfaces are not absolutely smooth. Scratches made in early passes may be closed in succeeding passes and will then resemble overlaps. High-nickel steels are especially sensitive to scratching by the slightest roughness in the guiding equipment. Very high rolling temperatures promote scratching. Use of guides with hardwood inserts is recommended for chromium steels.

Pool adjustment of guides can lead to "self-twisting" of round, square, and flat bars, and profiles. Such twisting may also be caused by poor roll alignment.

Poorly functioning rolls . . . "Grinding" of the grooves causes surface defects which align themselves in all imaginable directions. Too deep ragging causes projections on the billets which upon contact with the collars between the grooves may cause grinding. The ragging should be welded on the rolls and subsequently ground smooth.

Grinding can also result from the dragging of the bars against the rolls, especially in three-high mills working with overdraft where the diameter of the top roll is greater than that of the middle roll. Here, the bar is pushed against the front conveyor roll after having been disengaged by the scraper, and the dragging arises from the different velocities imparted to it from above and below. Hence, the greater the difference in roll diameter, the more roughened the rolls, together with a harder and colder steel, the greater becomes the drag. The layers of the material are differently strained when the drag is high. Defects originating from grinding and drag are usually discovered shortly after rolling, whereas faults due to a bad roll surface often are more difficult to identify.

Excessive rolling speed causes creeping between the rolls and product and this lessens the ability of the rolls to "bite" the steel. The grooves soon get rough in rolling alloy steels and may cause superficial cracks. Rolls must be as smooth as possible to produce a good surface on the steel. Excessive creep in combination with high draft may result in depressions due to tiny spotwelds (between the rolls and the steel); these are later squeezed together to form folds which appear as crack formations of almost any length under comparatively strong hot etching.

Pressure cracks are due to excessive spreading, especially in alloy steel. They are formed from the edging of a section wherever any fins have formed in the space between the rolls and are scarcely distinguishable from cracks due to folding.

Red short or hot short steel . . . This can leave the rolling mill entirely acceptable if properly heated and handled. Armco iron, for instance, is always red short and would disintegrate if rolled in the dangerous temperature range.

Pipe-Line Construction

THE Oil and Gas Journal's report on activity in the pipe-line industry includes major construction projects that are currently on proposed status. These uncontracted projects are designated by a • so that the reader may ascertain those projects contracted or already under way. This information is gathered first hand from pipe-line contractors and pipe-line companies and presented here as a biweekly service to Journal readers.

Crude-Oil Pipe Lines

• **California-Oregon Pipe Line System**—103 miles, 6-in., proposed, Crescent City, Calif., to Medford, Oregon.

• **Cities Service Pipe Line Co.**—64 miles, 18-in., planned, Sour Lake, Tex., to Lake Charles, La. Completion date April 1953.

• **Continental Pipe Line Co.**—217 miles, 12-in., planned, Wichita Falls, Tex., to Ponca City, Okla. Completion date 1952.

• **Cooperative Refinery Association.** — 48 miles, 6-in., planned, Phillipsburg, Kans., to Holdredge, Neb. Begin 3-53.

• **Gulf Refining Co.** — 80 miles, 24-in., under way Midland to Colorado City, Tex., Anderson Bros.

22 miles, 10-in., under way, Wortham to Corsicana, Tex., Anderson Bros.

• **Humble Pipe Line Co.**—71 miles, 16-18-in., planned, East Texas to Louisiana-Texas border. (30 miles of 16 in., and 41 miles of 18-in.) Completion date 10-53.

• **Interstate Oil Pipe Line Co.**—22 miles, 18-in., planned, Texas to Shreveport, La.

68 miles, 16-in., planned, Raceland to Anchorage, La. Begin 4-53.

137.6 miles, 22-in., planned, Shreveport to Baton Rouge.

Interstate Oil Pipe Line Co.—52 miles, 16-in., under way, Sunset to Anchorage, La. Houston Contracting. Completion date 11-52.

• **Magnolia Pipe Line Co.**—29 miles, 8-in., planned, Midland County, Texas area.

Malco Refineries, Inc.—60 miles, 4-in., under way, Pettigrew, Tocito field to Hospah field (San Juan basin, New Mexico).

• **Pan American Pipe Line Co.**—27 miles, 26-in., begin 11-52. Genoa to Texas City, Tex. Completion date 3-53.

47 miles 16-in., begin 12-52, Arden Station in Irion County to Eldorado Station in Schleicher County, Texas. 3-53.

Pasotex Pipe Line Co.—195 miles, 8-in., under way, El Paso to Wink, Tex. McVean & Barlow, contractor. Completion date 1-1-53.

• **Phillips Pipe Line Co.**—45 miles, 12-in., planned, Rancho system to Sweeny, Tex. 3-53.

Phillips Pipe Line Co.—50 miles, 14-in., under way, looping in Duro and Rankin, Tex. area.

Platte Pipe Line Co.—1,075 miles, 16-20-in., under way, Worland, Wyo., to Wood River, Ill. Completion date 1952.

Worland, Wyo., to Holdredge, Neb. R. H. Fulton & Co., contractor. A. A. Carrigan, spreadman at Scotts Bluff, Neb.

Holdredge, Neb., to Kansas State Line, Fulton & Brodie, contractor. J. T. Brodie, spreadman.

Section 7, Missouri River to Salisbury, Mo., and Section 8, Salisbury to Mississippi River, under way. O. R. Burden Construction Co. Al Perry, spreadman at Carrolton, Mo.; river crossing field office, Hartford, Ill. Dick Jernigan, spreadman.

• **Progress Pacific Pipeline Co.** — 1,100 miles, 24-in., planned, Odessa, Tex., to Los Angeles Harbor, Calif.

Rancho Pipe Line System.—455 miles, 24-in., under way, McCamey to Houston, Tex. Completion date late 1952. (Joint project with Sinclair Pipe Line Co., Pan American Pipe Line Co., Tidewater Pipe Line Co., Nantucket Pipe Line Co., Phillips Pipe Line Co., and Ashland Pipe Line Co. with Shell Pipe Line Corp. handling construction and operation.)

McCamey to Cedar Valley near Austin, Tex. Anderson Bros. Corp. A. Kilgore, spreadman at Menard, Tex.

(Segment 1)—Austin to Shell's Deer Park Refinery (Houston area). Oklahoma Pipe Line Constructors.

(Spread 1)—Brazos River west to Austin, Houston Contracting Co.

• **Roosevelt Oil & Refining Corp.** — 22 miles, 4 and 6-in., planned, St. Helens to Norwich, Mich.

• **Service Pipe Line Co.**—16-in., planned, Bowie, Tex., to Drumright, Okla.

30 miles, 6-in., Knox and Haskell counties, Texas.

29 miles, 4-6-8-in., proposed, Natrona County, Wyoming.

170 miles, 12-in., proposed, Tioga to Williston, N. D.

Sinclair Pipe Line Co.—674 miles, 22-24-in., under way, Cushing, Okla., to East Chicago, Ind. Completion date 1952.

Section 1, Drumright-Cushing, Okla., area, to Humboldt, Kans. O. R. Burden Construction Co.

(Spread 1) Caney to Humboldt, Kans. A. B. Haynes, superintendent at Chanute, Kans.

(Spread 2) Cushing, Okla., to Caney, Kans. Floyd Lewis, spreadman at Hominy, Okla.

Humboldt, Kans., to Salisbury, Mo. R. H. Fulton & Co., contractor. M. L. Boyd and Jerry Nash, spreadmen.

Salisbury, Mo., to Forest City, Ill. O. R. Burden, contractor.

22-in. Forest City, Ill., to East Chicago, Ind., Britton Bros., contractor.

• **Sterling Pipe Line System.**—53 miles, 12-in., planned, Sterling, Colo., to connection with Platte Pipe Line at Gurley, Neb. (Includes 20 miles, 10-in., main line; 35 miles, 8-in., branch lines). Joint venture comprising Toronto Pipe Line Co., Shell Pipe Line Corp., and Texas Pipe Line Co.

• **Sun Pipe Line Co.**—34 miles, 8-in., planned, Jameson to Colorado City, Tex.

20 miles, 6-in., planned, Claytonville to Colorado City, Tex.

• **Texas-Empire Pipe Line Co.**—30 miles, 18-in., planned, Wilmington to Lockport, Ill.

• **Texas-New Mexico Pipe Line Co.**—48 miles, 8-in., planned, from Lovington, N. M.

• **Toronto Pipe Line Co.**—100 miles, 6-10-12-in., planned, Merino, Colo., to Gurley, Neb.

• **West Coast Pipeline Co.**—960 miles, 20-22-in., planned, Synder, Tex., to Norwalk, Calif.

West Texas Gulf Pipe Line Co.—466 miles, 20-26-in., under way, Colorado City to Sour Lake, Tex. Anderson Bros. Completion date 1-1-53.

(1) Contracted, Middle section from Wortham toward Sour Lake, Tex.

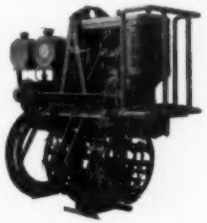
(2) Henderson County to Longview, Tex.

Products Pipe Lines

• **Bell Oil & Gas Co.**—150 miles, 6-8-in.,

...Here comes the most rugged and dependable
CLEANING AND PRIMING MACHINE
in the pipeline industry!

Designed to operate in all types of terrain, CROSE Line travelling cleaning and priming machines are equipped with dual multi-speed transmissions providing greater flexibility of control. Interchangeable cleaning and priming assemblies permit each model to process a wide range of pipe sizes. Model M handles 3" to 14" pipe, Model K handles 16" to 26" pipe and Model R handles 30" to 31" pipe.



M. J. CROSE MANUFACTURING COMPANY, INC.
TULSA, OKLA.
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planned, Ardmore to Drumright, Okla. Completion date 6-1-53.

Buckeye Pipe Line Co.—370 miles, 8-12-16-in., under way, Linden, N. J., via Allentown, Pa., to Auburn, Syracuse, Waterloo, and Rochester, N. Y. (Sections divided as follows: 75 miles, 16-in., 218 miles, 12-in., 77 miles, 8-in.). Completion of 16-in., 1952, balance 1953.

• **Coastal Products Pipe Line Co.**—260 miles, 20-in., proposed, Houston to Baton Rouge.

• **Harbor Products System**—86 miles, 16-in., planned, Philadelphia to Trembley Point, N. J. (Joint ownership of Sinclair Pipe Line Co., Gulf Oil Corp., and Texas Co.)

Indiana Farm Bureau Cooperative Association, Inc.—180 miles, 8-in., under way, Mt. Vernon to Indianapolis, Ind. R. B. Potashnick, contractor.

70 miles, 4-in., under way, Indianapolis to Peru, Ind. R. B. Potashnick, contractor.

Ohio Oil Co.—255 miles, 8-10-in., East St. Louis, Ill., to Indianapolis. Conyes Const. Completion date 11-52.

Phillips Petroleum Co.—50 miles, 8-in., under way, Goldsmith to Spraberry, Tex. McVean & Barlow. Completion date 12-52.

54 miles, 6-in., planned, Goldsmith to Borger, Tex.

52 miles, 10-in., planned, Shell's Brookshire system to Sweeny, Tex.

Phillips Pipe Line Co.—35 miles, 6-in., planned, Okmulgee, Okla., to Tulsa. Completion date 12-52.

Pioneer Pipe Line Co.—(Continental Pipe Line Co. and Sinclair Pipe Line Co.). 310 miles, 8-in., under way, Sinclair, Wyo., to Salt Lake City, Utah.

• **Progress Pacific Pipe Line Co.**—900 miles, 10-in., proposed, California to West Texas.

Salt Lake Pipe Line Co.—330 miles, 8-in., contracted, Salt Lake City to Boise, Idaho. Macco Corp., and Engineers, Ltd.

Shell Oil Co.—565 miles, 8-14-in., under way, Wood River via East Chicago to Detroit. R. B. Potashnick, contractor on Wood River—E. Chicago portion of project.

Shell Pipe Line Co.—266 miles, 24-in. under way, McCamey to Cedar Valley, Tex. Anderson Bros. Corp.

• **Sinclair Pipe Line Co.**—12-in., planned Sinco to Port Arthur, Tex.

• **Standard Oil Co. (Ind.).**—316 miles, 12-in., proposed, Sugar Creek refinery to Dubuque, Iowa. Completion date 1-1-53.

243 miles, 10-12-in., proposed, Whiting, Ind., to River Rouge, Mich.

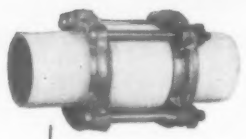
Sun Pipe Line Co.—110 miles, 8-in., under way, Fostoria to Hudson, Ohio.

• **United States Pipe Line Co.**—1,600 miles, 14-22-24-in., proposed, Port Neches, Tex., to Newark, N. J. (Includes 560 miles, 25-in., Port Neches to Jackson, Tenn.; 120 miles, 14-in., lateral to Paducah, Ky., and 1,045 to Newark).

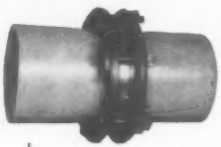
• **Wolverine Pipe Line System**—200 miles, 14-in., planned, Chicago to Toledo and Detroit. (Joint ownership of Shell, Texas, and Cities Service).

MIGHTY HANDY...to have around when leaks happen

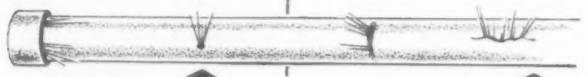
DRESSER CLAMPS

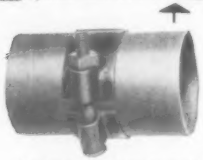


For leaks through threads of screw collars. *Collar Clamp*, Styles 4 and 44.

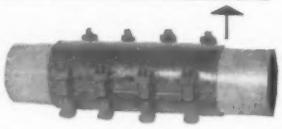


For repairing leaks in circumferential welds. *Porous Weld Clamp*, Style 55.





For leaks and holes in run of pipe. *Band Clamp* Style 778.



For repairing pitholes and longitudinal splits. *Split Repair Clamp*, Style 798.

Just four in Dresser's complete line of repair products. Be ready for fast repairs by keeping Dresser's in stock. They're your handiest, quickest way to repair leaks . . . in any weather . . . on any pipe . . . and without shutting down. Check your nearest oilfield supply store for any of Dresser's repair products, or write for our Oilfield Catalog.

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Natural-Gas Pipe Lines

• **Allied Gas Co.**—24 miles, 6⅝-in., proposed, McLean to Champaign County, Illinois.

• **Arkansas-Missouri Power Co.**—140 miles, 2 to 10-in., planned, St. Francis River, Clay County, Arkansas, to near Campbell, Mo.

• **Associated Natural Gas Co.**—88 miles, Missouri.

• **Carolina Natural Gas Corp.**—185 miles, 2-12-in., proposed, lateral lines off Transcontinental in North and South Carolina.

• **Chattahoochee Natural Gas Co.**—70 miles, proposed, Floyd County, Georgia, to Dalton, Ga.

Cities Service Gas Co.—179 miles, 4-30-in., gathering system in vicinity of Ulysses, Kans. Vaughn & Taylor Construction Co., Inc. D. D. Vaughn, spreadman, Ulysses.

15 miles, 20-in., Craig County, Oklahoma, to Lawrence County, Missouri.

Cities Service Gas Co.—21 miles, 26-in., planned, Franklin and Anderson counties, Kansas.

• **Coast Counties Gas & Electric Co.**—40 miles, 3, 4, and 8-in., planned. Coast and Valley region, California.

Colorado Interstate Gas Co.—250 miles, 20-in., under way, Kit Carson, Colo., to Amarillo, Tex. R .H. Fulton & Co., contractor. Jerry Nash spreadman at Lamar, Colo.

Pueblo County to Fowler, Colo.

• **Commonwealth Natural Gas Corp.**—537 miles, 20-in., proposed, West Bend, Ky., to Norfolk, Va.

• **Cumberland and Allegheny Gas Co.**—31 miles, 12-in., proposed, Garrett County, Md., to Keyser, W. Va.

Dow Chemical Co.—70 miles, various sizes, Midland, Saginaw, and Bay City, Mich. Mahoney Contracting Co., contractor. Ralph Bucher, spreadman at Midland.

• **East Tennessee Natural Gas Co.**—172 miles, 22-in., planned, Greenbrier to Oak Ridge, Tenn.

100 miles, 16-in., proposed, Knoxville to Kingsport, Tenn.

• **El Paso Natural Gas Co.**—822 miles, proposed, Permian Basin, N. M., and West Texas.

181 miles, proposed, field transmission lines.

97 miles, proposed, main transmission line on San Juan Basin, N. M. to California.

El Paso Natural Gas Co.—133 miles, 30-

in., under way, Kermit, Tex., to Colorado River, Company Crews. Completion date, December 1952.

• **Fredericksburg Natural Gas Co.**—29 miles, 3-4-in., planned, Fredericksburg, Va., area.

• **Georgia Gas Co.**—32 miles, 4½-in., proposed, Bogart to Gainesville, Ga.

• **Glacier Gas Co.**—285 miles, 20-in., proposed, Kalispell, Mont., to Spokane, Wash.

120 miles, 16-in., proposed, Spokane to Hanford, Wash.

91 miles, 8⅝-in., proposed, Spokane to Lewiston, Idaho.

130 miles, 12¾-in., proposed, Spokane to International boundary at Trail, British Columbia.

• **Gulf Interstate Gas Co.**—860 miles, 30-in., proposed, Acadia Parish, La., to Boyd County, Ky.

329 miles, 12 to 24-in., proposed. Laterals off Acadia Parish, Louisiana, to Boyd County, Kentucky, line.

• **Home Gas Co.**—32 miles, 12-in., planned, Breesport to Union Center, N. Y.

17 miles, 12-in., proposed, loops from Hancock to Sanford, N. .

46 miles, 12-in., proposed, Tioga and Broome counties, New York.

• **Hope Natural Gas Co.**—33 miles, 8-10-12-in., planned, Wyoming County, West Virginia, south to Buchanan County, Virginia.

Iowa-Illinois Gas & Electric Co.—41 miles, 10-in., planned, Washington County to Cedar Rapids, Iowa.

• **Kansas-Nebraska Natural Gas Co., Inc.**—179 miles, planned, Kansas and Nebraska.

18 miles, 6-8-in., planned, McCook, Neb., south. Completion date 1952.

54 miles, 4-6-in., planned, Neligh to Hartington, Neb. Completion date 1953.

20 miles, 12-in., planned, Atwood to near Oakley, Kans. Completion date 1952.

Kansas-Nebraska Natural Gas Co., Inc.—49 miles, 10-in., under way, Ogallala to North Platte, Neb. Engineering Const. Co. Completion date 1952.

• **Kansas Power & Light Co.**—27 miles, 20-in., planned, Pratt, Kans., to Calista compressor station.

28 miles, 12-16-in., planned, north of Kansas to Meade County gas field.

• **Lake Shore Pipe Line Co.**—75 miles, 10¾-in., under way, T.G.T. connection at Cochranton, Pa., to Fairport via Ashtabula, Ohio.

• **Lone Star Gas Co.**—100 miles, proposed, storage fields to the Dallas-Fort Worth area.

35 miles, 12-in., proposed, southeastern Schleicher County. 12-52.

Lone Star Gas Co.—70 miles, 20-in., under way, Garvin County, Oklahoma, to Clay County, Texas. 12-52.

• **Manufacturers Gas Light & Heat Co.**—40 miles, proposed, Allegheny, Washington, and Beaver counties, Pennsylvania.

213 miles, 3 to 26-in., proposed, various points on system in Pennsylvania, West Virginia, and Ohio.

• **Michigan Gas Storage Co.**—30 miles, 26-in., planned, Laingsburg Junction north.

• **Midsouth Gas Co.**—191 miles, planned, Helena to Palestine, Ark.

• **Mississippi River Fuel Corp.**—98 miles, 16 and 18-in., planned, feeder line from Lincoln Parish, Louisiana, to Waskom field, Harrison County, Texas.

40 miles, 18-in., planned, Dubach to Perryville, La.

Missouri Central Gas Co.—25 miles, 6-in., contracted, Moberly to Macon, Mo. L. R Young Const. Co.

• **Missouri Public Service Co.**—136 miles, 8-10-in., proposed, New Franklin to Trenton, Mo.

• **Montana Power Co.**—52 miles, 16-in. planned, Canada-Montana border to Cut Bank, Mont.

• **Morganfield Natural Gas Co.**—31 miles, 4-6-in., planned, through Sturgis, Providence Clay, Diamond, Wheatcroft, and Sullivan Ky.

Natural Gas Storage Co. of Illinois.—43 miles, 30-in., under way, Kankakee and Iroquois counties, Illinois. Ray L. Smith and Son. Completion date 11-30-52.

• **Nevada Natural Gas Pipe Line Co.**—114 miles, 10-in., planned, Topock, Ariz., to Las Vegas, Nev.

• **New River Gas Co.**—50 miles, planned Summers to Monroe counties, West Virginia to Narrows and Dublin, W. Va.

• **New York State Electric and Gas Co.**—59 miles, 8-10-24-in., proposed, Oneonta and Norwich to DeRuyter, N. .

New York State Natural Gas Corp.—104 miles, 14, 16, 20-in., under way, looping on Westmoreland, Armstrong, and Tioga counties, Pennsylvania. (Includes 17 miles, 16-in., in Potter County, Pennsylvania, and 21 miles 14-in., replacement in Line No. 507, New York.)

Utica to Amsterdam, N. Y. (to begin at completion of Zelienople). Williams-Austin. Howard Bauer, superintendent. Completion in 90 days.

Angelica to Rossburg, N. Y. (begin at completion of Cayuta-Ithaca). Williams-Austin. Howard Bauer, superintendent. Completion in 45 days.

Colesburg Junction to Sabinsville, Pa. (begin at completion of Angelica job), Williams-Austin. Howard Bauer, superintendent.

21 miles, Columbiana and Stark counties, Ohio.

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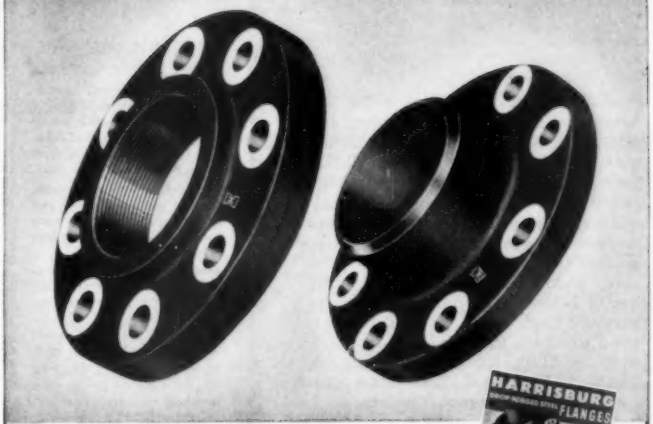

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• **New York State Natural Gas Co.**—95 miles, 16-20-in., planned, Clinton County to Armstrong County, Pennsylvania.

(Section 1) 16-in., Clinton County, Pennsylvania.

(Section 2) 20-in., Armstrong County, Pennsylvania, begin 1953.

29 miles, 20-in., under way, looping from Tonkin Station to Kittanning, Pa. Williams-Austin Co. Completion date 12-15-52.

• **Northern Natural Gas Co.**—380 miles, proposed, Kansas, Texas, Oklahoma, and Nebraska loops.

210 miles, 26-in., planned, five loops in Texas-Oklahoma area, two in Kansas, and two in Nebraska.

400 miles, 24-in., proposed, Emerson, Manitoba south to Red River Valley through Fergus Falls on to St. Paul, Minn.

102 miles, planned, extension.

Northern Natural Gas Co.—140 miles, 4-6-8-in., under way, south of Rolla, Kans., to Guymon, Okla. Reese Bros. Const. Co. E. H. Reese, spreadman at Hugoton, Kans.

• **Northern Indiana Fuel & Light Co.**—33 miles, 8-in., proposed, Edgerton to Auburn, Ind.

• **Northwest Natural Gas Co.**—750 miles, planned, Washington, Oregon, and Idaho.

24-in., Eastport, Idaho, to Monroe, Wash.

18-in., Monroe to International boundary near Lynden, Wash.

22-in., Monroe to near Seattle, Wash.

20-in., Seattle to Portland, Ore.

• **Ohio Fuel Gas Co.**—31 miles, 20-in., planned, Licking County to Richland County, Ohio.

22 miles, 16-in., planned, Dayton, Troy, Piqua, and Sidney, Ohio.

23 miles, 16-20-in., planned, Wellington to Elyria, Ohio; 16 miles, 20-in., planned, Benton Station to Crawford Station; 18 miles, 20-in., Crawford Station to near Columbus; 16 miles, 16-in., planned, Berlin to Sandusky, Ohio.

74 miles, 3 to 20-in., planned, Hocking, Knox, and Ashland counties, Ohio.

47 miles, 20-in., planned, Benton Township, Hocking County, to Columbus, Ohio.

61 miles, planned, northern and southwestern Ohio.

33 miles, 20-in., proposed, Jefferson to Seneca, Ohio.

• **Oklahoma Natural Gas Co.**—50 miles, 18-in., planned, Sapulpa to Choteau, Okla. 7-53.

20 miles, 8⅝-in., planned, Wewoka, Okla., south. 12-1-52.

• **Pacific Gas & Electric Co.**—50 miles, 12-16-20-in., planned, Fresno to Merced, Calif.

(Section 1) 16-in., Burrel to near Easton, Calif.

(Section 2) 20-in., Holm to Topock-Milpitas line.

(Section 3) 12-in., parallel existing Madera-Livingston line.

141 miles, 34-in., planned, parallel sections along Topock-Milpitas line.

Planned, Monterey to Fort Ord to Castroville; Napa Wye to Shellville; Cotati to Santa Rosa, Calif.

• **Pacific Northwest Pipeline Corp.**—1,384 miles, proposed, Ignacio, Colo., to Bellingham, Wash.

316 miles, proposed, laterals and spurs off main line to Pocatello, Idaho to Yakima, Wash.

Panhandle Eastern Pipe Line Co.—70 miles, 24-26-in., under way, looping from Sneed, Tex., to Emporia, Kans.

174 miles, 30 and 26-in., contracted. Tuscola, Ill., eastward—looping present system; R. A. Conyes, contractor.

26-in., Edgerton, Mich., Anderson Brothers.

30-in., looping in Tuscola, Ill.

30-in., looping in Montezuma, Ind.

30-in., looping in Zionsville, Ind.

• **Panhandle Eastern Pipe Line Co.**—19 miles, planned, Peoria County, Illinois.

Pennsylvanian Gas Co.—52 miles, 12-in., between Warren and Erie, Pa. Section 1—27 miles, under way and contracted by Harford Brothers, Section 2—25 miles.

• **Peoples Natural Gas Co.**—25 miles, proposed, Cambria and Blair counties, Pennsylvania.

• **Permian Basin Pipeline Co. (Northern Natural).**—384 miles, 20-30-in., proposed, Permian Basin and eastern New Mexico to Skellytown, Tex.

Upton County, Texas, to Lea County, New Mexico.

Lea County to Roosevelt County, New Mexico.

Roosevelt County, New Mexico, to Carson County, Texas.

• **Phillips Petroleum Co.**—125 miles, 2 to 24-in., planned, Midland, Upton, Glasscock, and Reagan counties, Texas. Completion date 3-53.

28 miles, 10-in., planned, Bayou Plant to Adams Terminal. Completion date 7-53.

Phillips Petroleum Co.—65 miles, 4 to 30-in., under way, Goldsmith field system, Texas. George Tucker, const. Completion date 1-53.

75 miles, 4-30-in., under way, Upton and Reagan counties, Texas. Vaughn & Taylor, 11-52.

• **Public Service Co. of Colorado.**—95 miles, proposed, Douglas Creek and other gas fields to Grand Junction, Colo., area.

• **Public Service Co. of North Carolina.**—83 miles, 8-in., planned, Kings Mountain to Asheville, N. C. Completion date 3-1-53.

• **Rockland Light & Power Co.**—22 miles, 8-in., proposed, Orangetown to Tompkins, Cove, N. Y.

• **Shenandoah Gas Co.**—39 miles, 3-4-8-in., proposed, Middleton, Va., to Martinsburg, W. Va.

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Battery Ignition Applications. Opens battery circuit and sounds an alarm . . . sounds an alarm only . . . opens battery circuit only.

Magneto Ignition Applications. Sounds an alarm only . . . grounds dual magneto . . . grounds magneto only . . . grounds magneto and sounds alarm or lights signal light.

Dual Ignition Applications. Opens battery circuit and grounds magneto.

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• **South Carolina Natural Gas Co.**—160 miles, 16-12-10-in., proposed, Aiken, S. C., to cities of Columbia, Summerville, and Charleston, S. C.

• **South Georgia Natural Gas Co.**—339 miles, 2-12-in., planned, Phoenix, Ala., to Tallahassee, Fla. (a) 12-in., Phoenix, Ala., to Albany, Ga. (b) 10-in., Albany, Ga., to Moultrie, Ga. (c) 8-in., Moultrie, Ga., to Tallahassee.

• **Southern California Gas Co.**—35 miles, planned, Antelope Valley, California.

• **Southern California Gas Co. and Southern Counties Gas Co. of California.**—45 miles, 30-in., proposed, looping on line from Arizona border to Los Angeles.

81 miles, 30-in., proposed, Whitewater to Desert Center, Calif.

Planned, looping between Blythe and Colorado River and on westward of Indio.

Southern Natural Gas Co.—1,235 miles, 24 to 4½-in., contracted, Louisiana, Mississippi, Alabama and Georgia, and South Carolina. Houston Contracting and H. C. Price.

88 miles, 24-in., Mississippi and Alabama.

(1) vicinity of Louisville, Miss. Houston Contracting.

(2) Reform, Ala., to Warrior River. Houston Contracting.

• **Southern Union Gas Co.**—21 miles, 20-in., planned, Albuquerque, N. M.

27 miles, 10-in., planned, Lea and Eddy counties, New Mexico.

Southern Union Gas Co.—30 miles, 12-20-in., contracted, San Juan County, New Mexico. R. H. Fulton & Co.

• **Southwest Gas Corp., Ltd.**—26 miles, proposed, from P.G.&E. line to Victorville, Calif.

• **Texas Eastern Transmission Corp.**—315 miles, 24-in., proposed, Provident City, Tex., to Castor, La.

• **Texas Gas Transmission Corp.**—400 miles, 26-in., planned, looping from Bastrop, La., to Hardinsburg, Ky.

180 miles, 26-in., Acadia Parish to connection with existing facilities in Morehouse Parish.

35 miles, 12-in., Slaughters, Ky., to Evansville, Ind.

560 miles, 26-in., proposed, Louisiana and Kentucky.

• **Texas-Ohio Gas Co.**—1,435 miles, 30-in., proposed, Hidalgo County, Texas, through Arkansas, Mississippi, Tennessee, and Kentucky on to Spencer, W. Va. Completion date 6-30-53.

• **Union Oil Co. of California.**—40 miles, 8-10-in., planned, San Joaquin Valley and Los Angeles basin

• **United Fuel Gas Co.**—50 miles, 20-24-in., proposed, Wood County to Lanham, W. Va.

• **United Gas Pipe Line Co.**—44 miles, 20-in., planned, Lirette field to Harvey, La.

Virginia Natural Gas Co.—153 miles Buckingham to Richmond and Portsmouth, Va.

Westcoast Transmission Co., Ltd.—(See foreign natural gas pipe lines).

Western Kentucky Gas Co.—2 to 4-in. under way, additions to present system; Modern Welding Co., Inc., contractor.

• **Western Pipe Lines.**—1,200 miles, 22-in. planned, southern Alberta to Duluth, Minn.

• **Wilcox Trend Pipe Line Co.** (Harry Bass Drlg. Co.)—150 miles, various up to 20-in., planned, gathering system for delivery to proposed Texas Eastern terminal at Provident City, Tex.

Foreign Crude-Oil Pipe Lines

• **Basrah Petroleum Co.**—72 miles, 24-in., planned, Zubair to Fao. Begin May 1953.

Canadian Gulf Pipe Line Co.—115 miles, 4-6-12-in., under way, Big Valley and Fenn fields to Stettler field, Edmonton, Alta., Canada. Anderson International Contractors, Ltd.

• **Cia. de Petroleo Ganso Azul, Ltd.**—48 miles, 4-in., planned, Ganzo Azul field to Pucalpa on upper Ucayali River, Peru.

Creole Petroleum Corp.—143 miles, 26-in., under way, Ule (State of Zulia) to Amuay (State of Falcon). Williams Bros. de Venezuela, S. A., contractor of overland sections, general superintendent, Maracaibo. McWilliams, Gahagan, and Anderson Brothers, contractors of water crossings. Completion date March 1953.

• **Creole Petroleum Corp.**—25 miles, 34 in., planned, Lagunillas to La Salina (State of Zulia). Completion date April 1953.

Direccion General de Yacimientos Petroliferos Fiscales.—409 miles, under way, Plaza Huincul to Bahia Blanca, Argentina.

Interprovincial Pipe Line Co.—100 miles, 16-in., contracted, Regina, Sask., to Gretna, Man., Canada. Anderson International Contractors, Ltd.

Iraq Government.—135 miles, 12-in., from Iraq Petroleum Co. at Baija to Baghdad, Iraq. Construction 1952. M. W. Kellogg, contractor.

• **Mene Grande Oil Co.**—12 miles, 26-in., Anaco to Puerto La Cruz.

• **Petroleos Mexicanos.**—145 miles, 12-in., considered, 18 de Marzo field via Reynosa to Monterrey, Mexico.

100 miles, planned, Isthmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan.

• **Saskatoon Pipe Line, Ltd.**—56 miles, 6-in., planned, Milden to Saskatoon, Sask.

Texas Petroleum Co.—60 miles, 4-6-in., under way, Pta. Nino to La Dorada.

Trans Mountain Oil Pipeline Co.—711 miles, 24-in., under way, Edmonton, Alta., to Vancouver, B. C. Canadian Bechtel, Ltd., engineers. Completion date 8-53.

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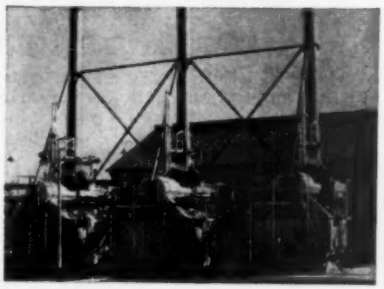

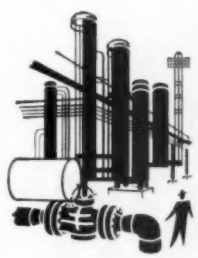

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(Spread 1) Acheson to Lake Yellowhead Comstock Midwestern.

(Spread 2) Lake Yellowhead to Blue River Comstock Midwestern.

(Spread 3) Vicinity of Vavenby, Mannix, Ltd.

Foreign Products Pipe Lines

Columbia Ministry of Petroleum—100 miles, 8-in., contracted, Contemplara to Pto. Salgar, Williams Bros. Corp.

75 miles, 4-in., planned, Buena Ventura to Cali, Colombia.

113 miles, 6-in., contracted. Puerto Berrio to Acededo near Medellin, Colombia, Carolina Construction Co.

• **Empresa Nacional del Petroleo**—80 miles, 6⅝-in., planned, Concon to Santiago, Chile.

Empresa de Ferrocarriles Ecuatorianos.—50 miles, 6-in., contracted, Guayaquil to Palmira, Ecuador. J. A. Jones, contractor; C.R.C. Engineering Co., engineers.

• **Governments of Southern Rhodesia and Portuguese East Africa.**—200 miles, considered, Beria, Portuguese Mozambique to Umtali, Southern Rhodesia.

Societe des Petroles au Congo. (Sub Cie. Financiere Belge des Petroles, S.A.).—225 miles, 6-in., under way, Ango-Ango to Leopoldville, Belgian Congo. Completion date 2-53.

Imperial Oil, Ltd.—64 miles, 12-in., under way, Sarnia to London, Ontario. Comstock Midwestern, Ltd.

Societe des Transports Petroliers par Pipe Line.—160 miles, 10-in., under way, Le Havre to Paris, France. Entrepose, contractor. Completion date 1953.

Trans-Northern Pipe Line Co.—440 miles, under way, Hamilton, Ont., to Toronto, Ont., to Montreal, Que., Canada. Contracted by Mannix-Williams Bros. Ltd.

Kingston to Toronto. Sparling Davis.

Kingston to Montreal and branch line to Ottawa. Williams Bros.

Foreign Natural-Gas Pipe Lines

• **Azienda Generale Italiana Petroli.**—110 miles, 12-14-16-in. Start 11-52. Cortemaggiore to Genoa. Completion date 11-53.

Azienda Generale Italiana Petroli—90 miles, 12-in., under way, Cortemaggiore to Bologna, Italy, SNAM crews.

120 miles, 16-in., under way, Cremona Porto Mar to Ghera, Italy, Montubi, contractor.

40 miles, 12-in., under way, Ripalta-Bergamo, Italy.

Direccion General del Gas del Estado.—310 miles, 8-in., under way, Plaza Huincul to Neuquen, Argentina, to the vicinity of General Conesa, Argentina.

• **Empresa Nacional del Petroleo**—80 miles, 10¾-in., planned, Concon to Santiago, Chile.

• **Northwest Natural Gas Co.**—950 miles, 24-in., planned, Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.

• **Petroleos Mexicanos.**—205 miles, 16-in., under way, Monterrey to Torreon, Mexico.

Petroleos Mexicanos.—260 miles, 20-in., considered, Monterrey to Tampico and Poza Rica, Mexico.

Under way, Salamanca to Guadalajara, Mexico.

• **Petroleos Mexicanos, Mexican Gas Co., and Industrial Gas Co.**—600 miles, planned, Reynosa, Tamaulipas, to Tampico-Poza Rica, Mexico.

• **Trans-Canada Pipe Lines, Ltd.** (Canadian Delhi Oil Co.)—2,247 miles, 14 to 30-in., proposed, Alberta to Toronto to Montreal.

747 miles, 8 to 24-in. gathering system in Alberta.

• **Westcoast Transmission Co., Ltd.**—1,110 miles, 24-in., planned, Dawson Creek, B. C., through Pine Pass and Fraser River Valley to Kamloops, Princeton, and Vancouver to Portland. Ford, Bacon & Davis, engineers.

280 miles, 20-in., planned, Pincher Creek to Montana on to Spokane, Wash. Ford, Bacon & Davis, engineers.

138 miles, 20-in., planned, Sumas to Tacoma, Wash.

139 miles, 18-in., planned, Tacoma, Wash., to Portland, Ore.

• **Western Pipe Lines.**—833 miles, 24-in., proposed, from southern Alberta, eastward across the Canadian prairies, serving principal towns and cities along the route to a point near the International boundary.

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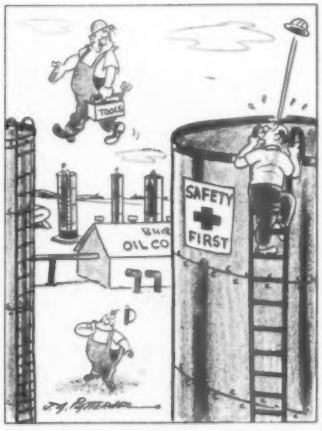

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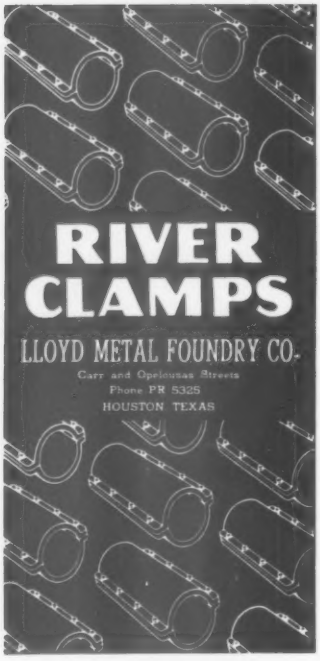

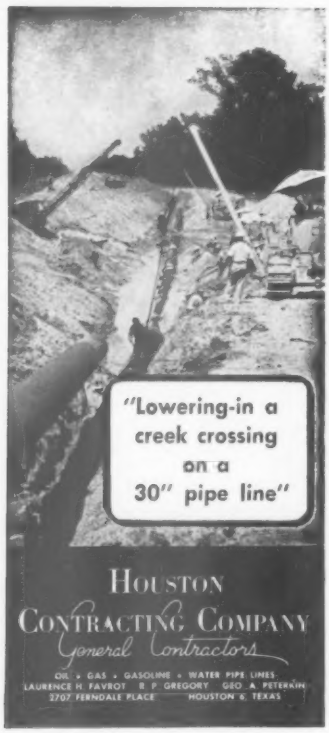
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PIPE LINES

New Products Line

Sinclair to start soon on Sinco-Port Arthur artery

HOUSTON.—Sinclair Pipe Line Co. will begin construction of a 90-mile products line from the company refinery at Sinco, Tex., near Houston, to Port Arthur as soon as right-of-way is secured and materials are available, a company official said here last week.

The 12-in. line would cost in excess of $3,000,000 and would be placed in operation during the third quarter next year, the Sinclair spokesman said. *(The Oil and Gas Journal, April 7, page 152).* Capacity of the line was not disclosed. Construction contracts have not yet been let.

Sinclair Pipe Line, a subsidiary of Sinclair Oil Corp., was granted a fast tax write-off last week by the Defense Production Administration of 25 per cent of $3,085,000 for the new line.

At Port Arthur the line reportedly will connect with a 195-mile, 16-in. line running from there to Baton Rouge, which in turn will feed products into the Plantation Pipe Line system for transportation on to the East. *(The Oil and Gas Journal, February 18, page 169).* The Port Arthur-Baton Rouge line will be laid by Texas Pipe Line Co., for itself, Sinclair, and Gulf Oil Corp. The line with a capacity of 96,000 bbl. daily, will be known as the Evangeline Products System. It will be owned 40 per cent by Texas Pipe Line, 40 per cent by Gulf, and 20 per cent by Sinclair.

First line pipe is scheduled to arrive for the Evangeline system early next year, and completion is scheduled for early summer. Construction of pump stations is expected to begin around November 15.

It is reported that completion of Sinclair's Sinco-Port Arthur line and of the Evangeline system will eliminate considerable barge shipments of products to Baton Rouge by Sinclair.

Court Order Halts Work On Algonquin Gas Line

PEEKSKILL, N. Y.—Construction of Algonquin Gas Transmission Co.'s natural-gas line across the property of six Westchester County, New York, property owners has been halted.

Counsel for the property owners served a temporary injunction order upon the contractor.

The work was ordered stopped by Supreme Court Justice Elbert T. Gallagher pending his decision on motions by the land owners' counsel for an order directing Algonquin to remove the pipe already laid and for payment of damages by the pipe-line company.

Gallagher meanwhile suspended his July 10 order permitting the company to take immediate easements across the lands in question under the eminent domain principle. Under this order, damages would have been determined later.

The work on the six properties is about all that remains to be completed, with about 95 per cent of the pipe for the 118-mile line across northern Westchester County already laid.

Continental Extending Crude Line to Wichita Falls, Tex.

PONCA CITY, Okla.—Continental Pipe Line Co. will start construction this week of a 127-mile, 12-in. crude line from Wichita Falls, Tex., to Oklahoma City.

W. L. Kygar, president of Continental Pipe Line, last week announced letting of contracts for the $4,180,000 line to R. H. Fulton & Co., Lubbock, Tex., and Western Construction Co., Hobbs, N. M.

The new line will have a capacity of 53,000 bbl. of crude daily and will connect with Continental's existing 8-in. line from Oklahoma City to Ponca City, where the company's largest refinery is located.

The company, a subsidiary of Continental Oil Co., also will lay an 18-mile, 12-in. loop along the Oklahoma City-Ponca City line in the Perry-Tonkawa area. The loop will add 17,500 bbl. to the line's present capacity of 21,000 bbl. daily.

Route of the 12-in. extension from Wichita Falls will extend north and slightly east past Waurika, Comanche, Duncan, Purcell, and Norman, to Oklahoma City.

Operation of the Oklahoma portion of the carrier will be supervised by D. S. Skinner, Oklahoma district superintendent for Continental Pipe Line at Ponca City.

Associated to Take Up 106 Miles of Texas Crude Line

HOUSTON. — Contract has been awarded by Texas Pipe Line Co. to Associated Pipe Line Contractors, Inc.,

S. E. HUEY & CO.
ENGINEERS & SURVEYORS
HENINGER BLDG.
MONROE, LA.

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Houston, to take up and reclaim 106 miles of 10¾-in. crude-oil pipe line.

The line which extends from a pump station at Erath, La., west to the Sabine River is no longer necessary due to the construction of a 22-in. crude line from Houma, La., to Port Arthur, Tex.

Work is scheduled to start early this week.

Full-Scale Laying of Pipe Proceeding on Rancho Line

HOUSTON.—Contractors are laying pipe at full speed again on the 455-mile, 24-in. Rancho crude line after 3 months of restricted operations due to pipe shortages caused by the steel strike

All materials needed to complete the line now are on schedule. Construction of the line had been confined principally to river-crossing and compressor-station work since July 11, when the contractors, Houston Contracting Co., and Oklahoma Pipe Line Constructors, ran out of pipe.

With the pipe-supply problem solved, contractors now have another headache. Completed eastern sections of the big West-Texas-to-Houston carrier have been tested at abundant water sources in South Texas, but the link from McCamey to Austin hasn't found enough water to justify a test. Testing is expected to be delayed until the Brazos River is reached. Water then will be pumped back through the line to McCamey.

Work on the eastern link now is proceeding west toward Austin where the eastern and western portions are expected to reach a juncture about March 1, 1953. The three compressor stations are expected to be completed about the same time. Both major river crossings already are ready for operation.

Transco, Texas Eastern Interconnection Approved

WASHINGTON.—The Federal Power Commission has issued a certificate to Transcontinental Gas Pipe Line Corp., Houston, and Texas Eastern Transmission Corp., Shreveport, to operate an interconnection near Philadelphia of the two trunk lines.

The facilities are used for deliveries by Transco to Texas Eastern, which in turn is delivering for the account of Transco up to 60,000,000 cu. ft. of gas daily to East Ohio Gas Co., New York State Natural Gas Corp., and Peoples Natural Gas Co., up to 10,000,000 cu. ft. daily to United Natural Gas Co., and up to 600,000 cu. ft. daily to Indiana Gas & Water Co.

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NATURAL GAS

Fight Brewing

Move to change allowable formula opposed in Texas

AUSTIN. — It is now apparent that Texas' 19-year-old practice of limiting production of gas wells to 25 per cent of their potentials will not be thrown out the window without an argument.

A hearing called last week on the subject by the Texas Railroad Commission was recessed until December 9 with no action taken after a Phillips Petroleum Co. spokesman maintained that the commission did not have the power to abolish the rule.

The commission is trying to change the rule, because it says, the 25 per cent limitation penalizes small wells and has caused a flood of applications for exceptions — nearly all of which have been granted.

In place of this rule, the commission wants to substitute another which would tie production to the "reasonable market demand which can be produced without waste."

Under this rule, allowable would be determined by fields and distributed to individual producers on the basis of one-third well and two-thirds acreage, with 160 acres as the basic proration unit. The present rule which allows operators to make up underproduction in a 6-month period during the next 6 months would be retained.

E. H. Foster of Phillips said the present rule could not be changed because it is in the statutes.

Commission officials retorted that the present rule is unworkable. A percentage of a well's potential can't be determined, they said, because the law does not define what constitutes a potential. Also the methods now employed to determine open-flow gas potentials are notoriously inaccurate.

Court Advances Date for Appeal of Gas-Tax Decision

AUSTIN.—The Court of Civil Appeals here has granted a motion by Texas Attorney General Price Daniel to advance hearing date for the state's appeal for an adverse lower-court decision on its gas-gathering tax from January 21, 1953, to December 3 this year.

The hearing date was set up so that a decision in three test cases involving suits by Panhandle Eastern Pipe Line Co., Michigan-Wisconsin Pipe Line Co., and Amarillo Oil Co. can be heard before the Texas legislature winds up its 1953 session. The session starts the second Tuesday in January.

Reportedly, if the appeals court rules against the state, the legislature would try to pass another tax aimed at interstate pipe lines.

Governor Shivers said here last week that he believes the present law will be upheld.

The tax law went into effect in September 1951. During the first year the state took in $11,871,928. Of this amount, $7,582,021 was paid under protest. The state can spend none of the protested funds unless the state wins the lawsuit.

Natural Gasoline

$5,000,000 Contract Let For Pledger Field Plant

HOUSTON. — Southern Production Co., Inc., Fort Worth, and Humble Oil & Refining Co., Houston, have let contract for a new absorption-type natural-gasoline plant in Pledger field, Brazoria County, Texas.

The plant will cost between $4,500,000 and $5,000,000 and will have a processing capacity of 190,000,000 cu. ft. daily.

Contract went to Stearns-Roger Manufacturing Co., Denver. Construction is expected to be completed late next year.

The new plant will replace an older one, now too small. According to plans for the installation as revealed earlier *(The Oil and Gas Journal, May 5, page 305)*, liquids extracted from gas of both companies will go to Southern Production's account. It is anticipated that the dry gas will be sold for industrial use.

Only a limited quantity of gas was marketed prior to the signing by Southern Production and Humble of a 20-year, $100,000,000 agreement late last year for the exchange of natural gas from Texas and Louisiana fields.

N.G.A.A. and Oklahoma U. Offer First Analysis Course

NORMAN, Okla.—The first school to train gasoline-plant operators in low-temperature fractional analysis has been opened at the University of Oklahoma under the sponsorship of the Natural Gasoline Association of America.

Ten students from Oklahoma, Texas, Louisiana, New Mexico, and Illinois have left plants and laboratories in these states to take the 3-week course. Another course will begin immediately after this session is concluded.

Students receive instruction on equipment valued at about $20,000, which was donated by Podbielniak, Inc., Chicago, and Burell Corp., Pittsburgh.

Equipment includes one manual, one semiautomatic, and one fully automatic fractionating column. Other studies are being made with auxiliary equipment involving refractionating and vapor-phase cut-point determination and Orsat analysis.

Plans for the school came into being after a series of N.G.A.A. tests disclosed widely varying results resulted from analyses of the same liquid hydrocarbon sample by 76 different companies and commercial laboratories.

Campus headquarters for the school is the O. U. School of Chemical Engineering. Instructor is S. T. Preston, formerly a member of the University of Texas faculty and an associate engineer for California Research Corp. from 1948 to 1951.

Damaged Paloma Unit Plant Placed in Limited Operation

BAKERSFIELD.—The Paloma unit gas-cycling plant which was heavily damaged by the late July earthquake and subsequent fire is back in partial operation.

The high-pressure section of the plant has resumed normal operation, compressing about 65,000 M.c.f. of gas daily for return to the producing horizon. The low-pressure section, which has a daily capacity of 60,000 M.c.f., is to be placed back on stream this month.

Also still not replaced are the five natural-gas and butane storage tanks destroyed by the quake and fire. C. F. Braun & Co. is doing the rebuilding work.

Damage by the quake and fire now is estimated to have reached almost $2,000,000. Centering in the new plant addition completed in 1951, fire from toppled spheres and ruptured lines destroyed a cooling tower, damaged compressors, and caused extensive havoc in the process area.

Western Gulf Oil Co. is operator of the Paloma Unit, which normally has a black-oil production of about 8,300 bbl. daily. This week the field was back to production of between 50 and 60 per cent of capacity. It will resume full production when the low-pressure section of the plant is placed back on stream.

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Plug Valve Lubrication
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REFINING

Profits Up

Refiners' rate of return in 1951 gains 1.4 per cent

WASHINGTON. — Thirty-eight petroleum-refining corporations, which had a rate of return (after taxes) on stockholders' investment of 6.7 per cent in 1940, had a rate of 15.7 per cent in 1951 after adjustment to exclude reported accelerated depreciation on postwar facilities, the Federal Trade Commission reported last week.

A commission survey of profits in 25 selected industries showed that the 38 refining corporations had profits, before taxes, of $2,500,000,000 in 1950 and $3,320,000,000 in 1951, an increase of $82,000,000 or 33 per cent. Their profits after taxes, however, were only $1,766,000,000 in 1950 and $2,133,000,000 in 1951—an increase of but $367,000,000 or 21 per cent.

Decline from 1951 . . . The effect of taxes on profits is shown more graphically by the commission in a computation of the rate of return on stockholders' investment. In 1950 the rate was 19.4 per cent before taxes and 14.3 per cent after taxes, while in 1951 the rate before taxes rose to 22.8 per cent but was only 15.7 per cent after taxes.

The refining industry was one of only two of the 25 surveyed that could show higher profit rates in 1951 than in 1950. The remaining 23 all reported declines, six of them to levels under 1940. The increase from 6.7 to 15.7 per cent between 1940 and 1951 was the greatest reported for any industry.

Humble Lets Contract for Biggest Deasphalting Plant

HOUSTON.—Humble Oil & Refining Co. has let contract for design and construction of a solvent-deasphalting plant claimed to be twice as big as the largest ever designed.

The new plant will charge 28,000 bbl. per day of vacuum-reduced crude at Humble's Baytown, Tex., refinery. It will provide additional clean feed stock for two recently enlarged fluid cat crackers at the refinery. The crackers will take 110,000 bbl. of charge stock daily.

It is understood that the new unit will be unique in other respects. It will charge a residual fraction from vacuum crude distillation. Similar units employed in making deeper cuts for catalytic feed stocks have operated on atmospheric crude bottoms or topped crude.

Contract for both design and con-

NELSON REFINERY CONSTRUCTION INDEX

Appears in the first issue each month.

Explanation—"New Items That Appear in Quarterly Cost Indexes," July 7, 1952, pages 105 and 106.

Compiled by W. L. Nelson—Petroleum Refinery Consultant—Tulsa.

Indexes of Individual Equipment Items—January, April, July, and October.

INDEX (1946 = 100)

	1948	1949	1950	1951	July 1952
Pumps, compressors, etc.	127.0	135.9	138.2	155.9	155.6
Electrical machinery	127.6	130.9	134.9	154.3	152.0
Internal combustion engines	116.9	124.8	126.0	146.1	145.8
Instruments	120.0	122.0	127.8	142.3	148.1
Heat exchangers	130.0	133.0	140.0	152.0	163.0
Miscellaneous equipment average	122.1*	121.6*	126.2*	145.1*	152.9
Materials component	139.3	143.6	149.3	164.0	162.7
Labor component	128.0	137.1	144.0	152.5	164.1
Refinery construction index	132.5	139.7	146.2	157.2	163.5

*Used in computing the Nelson Index until April 1952. These are slightly different from the average of the Miscellaneous Equipment Items shown above.

struction was let to M. W. Kellogg Co., New York City petroleum and chemical engineer - contractors. Construction is scheduled to start early in 1953.

Plans also are in the blueprint stage for a new catalytic polymerization unit at the Baytown plant. Humble has obtained a $4,800,000 fast tax write-off certificate for the poly plant and presently is planning to start construction early next year.

The new unit will process propylene produced by the cracking units.

Humble's Baytown plant now has a crude-charge capacity of approximately 286,000 bbl. daily.

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A.S.P.P.A. in Market for 40,000,000 Bbl. of Products

WASHINGTON. — The Armed Services Petroleum Purchasing Agency is in the market to buy more than 40,000,000 bbl. of refined products in this country for delivery during the first half of 1953.

The agency now is asking for bids on its requirements for the first 6 months of next year as well as for the unfilled portion of its 1952 needs. Total requirements are placed at 40,481,000 bbl. and include the following:

Aviation gasoline: 8,152,200 bbl., 115/145 grade; 4,189,900 bbl., 100/130 grade; 508,200 bbl., 91/96 grade; and 6,000 bbl., 80 grade.

Jet fuel: 3,237,900 bbl., JP-4: 442,-200 bbl., JP-3.

Navy special: 12,500,000 bbl.

Diesel oil: 3,430,000 bbl., Class 1; 1,443,000 bbl., Class 3 — 70°; 345,-000 bbl., Class 3 — 40°.

Motor gasoline: 5,785,000 bbl., 80/86 grade 330,000 bbl., 74/78 grade; 60,000 bbl., unleaded.

Consolidated to Erect Acid Plant Near Humble Refinery

HOUSTON. — Ground has been broken for a sulfuric acid-manufacturing plant at Humble Oil & Refining Co.'s Baytown refinery, according to an announcement by Humble and Consolidated Chemical Industries, Inc.

Feed stock to the plant, which will be built by Consolidated, will be hydrogen sulfide recovered from processing of crude and certain acid sludges from various refining processes.

Refining Briefs

The 1952 award for the year's outstanding trade association was presented last week in Chicago to the National Lubricating Grease Institute at its twentieth annual convention. The awards jury was headed by Charles Sawyer, head of the Department of Commerce. Other members were William J. Grede, president of the National Association of Manufacturers; D. A. Hulcy, president of the U. S. Chamber of Commerce; Edward H. Stromberg, Northwestern University; and Dr. Ray B. Westerfield, Yale University.

Esso Standard Oil Co.'s Charleston, S. C., refinery recently completed 1,010 days without a lost-time accident and broke the record for refineries operated by Jersey Standard affiliates. The former record of 1,008 days was set in 1944 by the Esso refinery at Everett, Mass.

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We specialize in removing excess circumferencial weld material inside Pipe Lines so that a "go devil" under air pressure can be used to clear out surplus oil.

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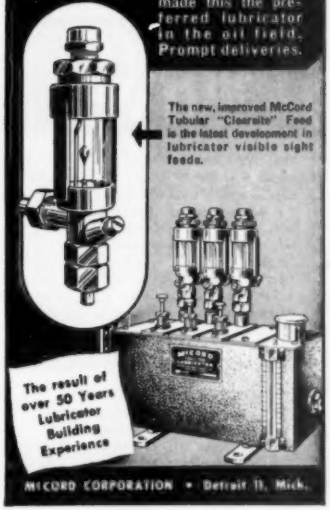
The McCord "SF" Lubricator provides close and accurate feed adjustments with a degree of reliability that has made this the preferred lubricator in the oil field. Prompt deliveries.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Among the Drilling Contractors

Decline in Active Rigs Is Believed Temporary

The small decline in the number of operating rotary rigs in the United States and western Canada during the week ended October 27 is believed only a temporary interruption in the generally upward trend in drilling activity that began two months ago and which is expected to continue during the remainder of year.

ACTIVE ROTARY RIGS*

(United States and Western Canada)

Area—	Week ended 10-27-52	Change week ended 10-20-52	Change week ended 10-29-51
Gulf Coast	568	−25	− 55
N. & W. Tex.-N. M.	784	− 7	−244
Ark.-N. La.-E. Tex.	153	− 1	− 31
Oklahoma	316	+ 3	− 13
Kansas-S. Nebraska	177	+ 6	− 22
Illinois-Eastern	141	− 1	− 14
Rocky Mountains	260	0	+ 66
Pacific Coast	170	+ 3	− 5
Total U. S.	2,569	− 8	−318
Western Canada	184	− 3	+ 30
Total	2,753	−11	−288

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and Rocky Mountains and Western Canada areas are shown on pages 168 and 169.

Operating rigs reported during the week totaled 2,753, only 11 below the total of the previous week. A drop of 25 in the number of rigs operating on the Gulf Coast was largely responsible for the over-all decline. Increases in activity in most other areas offset most of this decline. Activity in the Rocky Mountain region continued at a record level.

Empire National Drilling Co. is the contractor on a wildcat test being started by D & L Oil Co. of Oklahoma City in the extreme eastern part of Noble County, Oklahoma. Location is for 1 O'Donnell, in the NE NE NE 12-23n-2w. It is near the Pawnee County line.

Falcon Seaboard Drilling Co., Tulsa, is the contractor on three additional newly started wildcat tests in the northeastern Colorado portion of the Denver-Julesburg basin. Two of the tests are in Logan County, one being drilled for Vaughey & Vaughey at 1 Strouse, C NW SE 28-9n-53w, south of the Walker field, and the other for Ryan Oil Co. at 1 Good, C SW SW 13-9n-54w, north of the Graylin field. The third test, in Morgan County, is being drilled for La Gloria Corp. at 1 Government, C SE NW 26-4n-55w, 5 miles east of Bush.

Wheless Drilling Co., Shreveport, has a contract from the California Co. for an 8,700-ft. wildcat test to be drilled in Union County, Arkansas. Location is in the C NW SE 29-18s-17w on the operator's Mae Moore Smith lease. It will test the Smackover lime potentialities.

On the floor of a rotary rig Crescent Drilling Co., Monroe, La., has under contract to Joe B. White and associates in the Haynesville field, Claiborne Parish, North Louisiana. H. M. Harris (right) is tool pusher. With him, left to right, are: S. H. Milam, J. D. White, J. G. Bays, and J. R. Cullins, crew members. Picture by courtesy Mission Manufacturing Co.

Kern-Trimble Drilling Co., Magnolia, Ark., drilling for McAlester Fuel Co., is starting another Graves sand test in the East Pace City area of Ouachita County, Arkansas. The new location, 1-B Peace, in the NW NW NW 27-15s-17w, is about ¾ mile from production. Objective is around 2,600 ft.

Loffland Brothers Co., Tulsa, is drilling another well for Continental Oil Co. in the Seiling area, on the Dewey-Major county line, western Oklahoma. The new operation, 1 Meat, located in the C NW SE 3-19-16w, on the Dewey County side of the line, is about a mile southeast of the first well, 1 Kimball, in Major County, completed last April as a gas-distillate discovery producer in Chester lime. It is projected to 8,700 ft.

Southern Production Co., Shreveport, has a new 10,000-ft. contract job under way in the Port Barre field, St. Landry Parish, Louisiana, where it is drilling for the William Helis estate. The newly started well is 3-A Sibille, in 7-6s-6e.

Rainbow Drilling Co., El Dorado, Ark., is handling the contract for Curtis Kinard's new Travis Peak wildcat, 1 Suggs, located 2 miles northeast of Perdue City in the SW SE SE 35-16s-14w, Union County, Arkansas. Contract is for 3,700 ft.

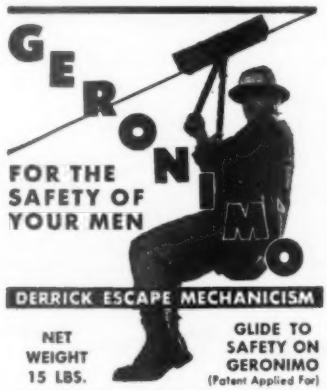
Hawke Drilling Co., Ltd., Regina, Sask., has a new wildcat operation under way for Socony-Vacuum Oil Co. in the Roseray area, 6 miles west of the Fosterton field, and 35 miles northwest of Swift Current, in southwestern Saskatchewan Province, western Canada.

Rocky Mountain Drilling Co., Los Angeles, is drilling for Canada Southern Oils, Ltd., at a newly started wildcat test in the Onward area, southern Saskatchewan Province, Canada. Location, in LSD 7, 10-34-24w3, is 12 miles northeast of the recently completed Buffalo Coulee discovery well.

Olds Drilling Co., Casper, Wyo., is moving a rig to a wildcat location 10 miles east of Alliance, Box Butte County, northwestern Nebraska, where it is under contract for a test to be drilled for Harry Royster at 1 Pierce, in the C NW NW 22-26n-49w.

Big West Drilling Co., Dallas, is contractor on a new Tensleep test which George J. Greer, as trustee, is starting near the latter's recently completed discovery well of the Snyder field, 8 miles northeast of Hardin, in the Nine Mile area of Big Horn County, Montana. This area is the northernmost production for the Powder River basin. The new test is 1 Otten, located in the C SW NE 32-1n-34e.

Westbury Drilling Co. has contracted with Davidor & Davidor of Oklahoma City for another well, the third, to be drilled for the recently opened East Guthrie Lake pool, in Logan County, Oklahoma. The new operation is 1 Oklahoma A. & M. College, spotted in the SW SW NE 4-15n-2w. The pool's production is from Bartlesville sand found at a depth of 5,600 ft.



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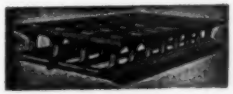

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We wish to take this opportunity to express our highest respect to the engineers, workman, and inspectors of the Diamond Chain Company for producing a top quality product for the petroleum industry. You are cordially invited to visit our Franks "Rockets" on location, at any time.

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REPORTS ON

Exploration and Drilling

Thumbnail Sketches of Williston

PROOF that big oil exists in Williston basin areas apart from the great regional structures has yet to be found; however, as exploratory activity throughout the basin is high, that picture might change at any time.

So far the best indication of potentially big oil off North Dakota's Nesson anticline or eastern Montana's Poplar and Cedar Creek anticlines has been found at the northeastern edge of the basin. There stratigraphically trapped oil is being developed by a growing list of small Mississippian wells.

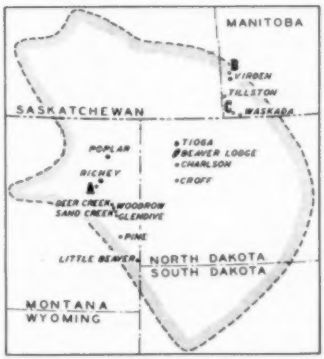
Here's a series of brief summaries designed to present a picture of development progress in the Williston basin up to the last week in October:

North Dakota . . . There has been no discovery of oil in North Dakota off the Nesson anticline. The 62 oil wells on that big feature have been completed in the Mississippian-Madison formation. Producing capacity is about double the current takings of roughly 6,000 bbl. daily. There are 25 drilling wells and 25 additional locations staked on the regional anticline.

South Dakota . . . There is no oil production in this state, but only three wildcats have been drilled within acceptable limits of the Williston basin in South Dakota since interest was revived by the North Dakota discovery in April 1951.

Montana . . . Development in the Mississippian-Charles on the Poplar anticline stands out in the Montana portion of the Williston basin. East Poplar unit now has 10 completed wells and an indicated discovery 4 miles northwest of the main cluster of wells.

Richey, Montana's first significant Williston basin discovery, is on a small structure between the Poplar and Cedar Creek anticlines. Here is the only production in the United States' portion of the basin that is not located on one of the three tremendous structural features. Richey's five Mississippian-Charles producers (three of which had considerable water) and its six dry holes do not make the immediate area appear too promising. However, a current indicated Devonian (?) discovery (A on sketch), 12 miles to the southwest on a separate structure, has improved the outlook for the general area.



There are now six proved or apparently assured producing areas on the long Cedar Creek anticline where production is found in Mississippian and Devonian or older rocks. Because of leasing arrangements, development drilling through this area has been retarded in favor of rank wildcatting. Wildcats in the Deer Creek to Glendive areas are strung out for about 15 miles. Only three wells in the area have been officially completed, two discoveries and a confirmation well. On to the south, Pine area has two producing oil wells and a third testing. At Little Beaver Creek there is just the discovery well, but a confirmation test is drilling.

Saskatchewan . . . Though several wildcats in the Williston basin portion of this province have recovered free oil in the Mississippian, there has been no discovery completed. A few miles to the northeast of the junction of the North Dakota-Montana line and Canada's border, a wildcat, which recovered some free oil on a drill-stem test of the Mississippian, is testing. A potential Lower Cretaceous (?) discovery lies near the Manitoba line about 50 miles northwest of Virden field.

Manitoba . . . Development in the southwest corner of this province continues steadily. Mississippian production has been proven at three spots over a distance of about 65 miles. Two more Mississippian discoveries appear assured (B and C on sketch). Virden field, where the only development drilling has taken place, now has more than 20 producing wells.

Williston basin's initial excitement has calmed; but, with more than 40 rank wildcats drilling in this extensive sedimentary unit, additional excitement may develop momentarily.

Philip C. Ingalls.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

WEST TEXAS . . . Fullerton Oil Co. has completed 1 Zorns as a flowing discovery from the Pennsylvanian reef lime in south-central Terry County. The new field opener is 6¾ miles south of Brownfield. The well reported a 24-hour potential of 522 bbl. of 44.3°-gravity oil, flowing through a 10/64-in. tubing choke.

MONTANA . . . C. H. Murphy, Jr., 10 Unit, C SW NW 30-29n-51e, wildcat discovery 4 miles north of first production in East Poplar field, flowed oil at the rate of 28 bbl. hourly on drill-stem test to establish a second pay zone.

OKLAHOMA . . . Wildcat discoveries in Beaver County continue to hold the spotlight in Oklahoma's Panhandle portion of the Anadarko basin. J. Tom Grimett and American States Oil Co.'s 1 Hennigh, SW SE NE 11-6n-28eCM, is being cleaned before further testing. J. M. Huber Corp. has a new gas-distillate producer 2½ miles east of Light field and about 2½ miles northwest of Greenough pool.

Permian Basin

Terry County Reef Discovery Completed

MIDLAND.—Completion has been made at Fullerton Oil Co. 1 Zorns, Terry County reef discovery, and applications filed for stepout tests to the strike.

The discovery rated 522 bbl. of 44°-gravity oil a day, based on a 12-hour flow test of 261 bbl. of oil through 10/64-in. choke, from perforations at 10,007-31 ft. Top of the Pennsylvanian reef was 9,970 ft. on elevation of 3,286 ft.

Fred Turner Jr. and Lynn D. Durham 1 Manton Rawls was to be drilled as a 10,300-ft., 1½-mile southwest outpost to the discovery. Location is NE NE 146-T-D&W. Fred Turner also scheduled 1 May to be drilled ½ mile northeast of the discovery in Section 119.

In northwest Terry County a northeast outpost to Alex San Andres field was scheduled to be drilled to 8,350 ft. The well was originally drilled as Livermore 1 Brownfield, and was dry at 5,253 ft. Location is 16-D14-C&M Survey.

Amerada Petroleum Corp. 1 Weems, prospective Yoakum County wildcat, had total depth at 11,860 ft. and was running electrical surveys. Fractured dolomite with good porosity and oil stains was cored between 11,772-803 ft.

Magnolia Petroleum Co. 1-36995 University has established flowing Devonian production south of its Magutex discovery. On drill-stem test from 12,501-31 ft. water cushion flowed in 1 hour and five minutes and oil 4 minutes later. It was cleaned into pits for 15 minutes, then tanked 76 bbl. of 43°-gravity oil in 2 hours. Open flowing bottom-hole pressure was 3,264 psi. Oil in the pipe was reversed out and coring continued below 12,542 ft.

Magnolia's south outpost, in Section 17, had top of the Devonian at 12,493 ft. on elevation of 3,031 ft., reported to be 157 ft. high to the same formation in the discovery well. Magnolia 1,36991, ½-mile north outpost to the Magutex discovery, was drilling below 13,476 ft. in line and chert.

Ralph Lowe 1-K Fasken, Midland Farms field deep test, Andrews County, found water in the Ellenburger and has been plugged from 13,016 to 10,250 ft., in the lower Pennsylvanian. Operators were running casing for tests in the Pennsylvanian, which indicated possible production from several sections that were drill-stem tested.

In Presidio County, Gulf Oil Corp. 1 Mitchell Bros., 25 miles southeast of Marfa, was fishing at total depth of 15,110 ft. It is an old well being drilled deeper from 9,998 ft.

Phillips Petroleum Co. 1-CC University, northeast Andrews County wildcat, plugged back to 13,905 ft. and perforated in the Ellenburger from 13,852-86 ft. After being swabbed in, the well flowed 1,000 bbl. of fluid in 12 hours, cut with drilling fluid. Estimated potential on the well was around 2,000 bbl. of oil a day.

Phillips 1-C Puckett, northwest of the firm's 1 Glenna, Pecos County gas discovery, developed gas and distillate on a drill-stem test from 9,015-56 ft., identified as the Permo-Pennsylvanian section. Gas gaged 516,000 cu. ft. daily and recovery was 10 ft. of distillate, plus 150 ft. of distillate-cut mud and 553 ft. of distillate-cut water blanket.

Magnolia 1-R TXL, ½-mile west extension to Pegasus-Pennsylvanian field of Midland County, gaged 236 bbl. of 44° gravity oil in 15 hours through 16/64-in. choke. The test was on perforations between 10,571-99 ft., before acid treatment.

WEST TEXAS (DISTRICTS 8 AND 7-C) SUCCESSFUL WILDCATS

Crockett County: Barron Kidd 1-B Pure-Dean, 60-OP-GC&SF, TD 1,143 ft., elev. estimated 2,572 ft., Queen sand 1,136 ft., IP pumped 10 bbl. 31°-gravity oil.

Barron Kidd 1-A Pure-Dean, 81-OP-SC&SF, TD 1,486 ft., elev. estimated 2,602 ft., pay 1,364 ft., IP pumped 5 bbl. oil.

Garza County: R. S. Anderson 1 Clyde Miller, 39-6-H&GN, TD 3,074 ft., elev. estimated 2,305 ft., pay 2,429 ft., IP pumped 26 bbl. 37°-gravity oil.

WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Andrews County: P. A. Doheny 1 N. N. Perkins, 7-A43-PSL, dry, TD 9,435 ft., elev. 3,196 ft., Pennsylvanian 8,680 ft.

Crockett County: Continental Oil Co. 1-B Harris, 17-HH-GC&SF, dry, TD 8,780 ft., elev. 2,766 ft., Devonian 7,440 ft., Simpson 7,642 ft., Ellenburger 8,216 ft.

Humble Oil & Refining Co. 1 C. E. Davidson Jr., 5-F-GC&SF, dry, TD 10,101 ft., Strawn 8,926 ft., Ellenburger 9,542 ft.

Crockett County: Byron Williams 1 John Childress, Sec. 28½, Blk. CD, P. L. Childress Sur., dry, TD 1,497 ft.

Culberson County: El Paso Natural Gas Co. 1-L Grisham-Hunter, 31-54-PSL, dry, TD 10,610 ft., elev. 3,615 ft., Wolfcamp 7,252 ft., Devonian 10,529 ft.

Hill & Hill 1 Grisham Hunter, 2-G17-PSL, dry, TD 2,690 ft., elev. 3440 ft., Delaware lime 2,511 ft., sand 2,566 ft.

Gaines County: Marlowe Oil Co. 1 Newsom, 1-AX-PSL, dry, TD 7,175 ft., elev. estimated 3,311 ft., Clear Fork 6,315 ft., Tubb 6,940 ft.

Brinkerhoff Drilling Co. 1 J. O. Jones, 12-H-D&W, dry, TD 9,161 ft., elev. 3,153 ft., Spraberry 7,225 ft., Dean 8,125 ft., Wolfcamp 9,132 ft.

Kent County: Ohio Oil Co. 1 Gaskill, 4-B-PSL, dry, TD 6,209 ft., elev. 2,298 ft., Canyon 6,178 ft.

Kimble County: R. F. Schoolfield 1 Dan Morales, H. Grote Grantee Sur. 423, dry, TD 1,380 ft.

Anzac Oil Co. 1 W. L. Pfluger, Kimble CSL Sur. 751, dry, TD 2,138 ft., Ellenburger 1,986 ft.

Lynn County: Great Western Drilling Co. 1 Bryan Williams, 1,409-1-EL&RR, dry, TD 9,030 ft.

Reeves County: J. S. Hill & W. W. Meeker 1 Grisham-Hunter, 21-55-PSL, dry, TD 3,002 ft., elev. 3,262 ft., Delaware lime 2,485 ft., sand 2,525 ft.

Runnels County: Barney Milburn Drilling Co. 1 L. V. Jones, J. Farewell Sur. 313, dry, TD 5,140 ft.

Schleicher County: Taylor Oil & Gas Co. 1 Sadie J. Wedell, 74-M-GH&SA, dry, TD 6,348 ft., elev. 2,350 ft., Strawn 5,764 ft., Ellenburger 6,164 ft.

Westbrook Oil Corp. 2-A Baugh, 8-M-GH&SA, dry, TD 496 ft.

Tom Green County: P. O. Echols 2 Bubenick, H. Fey Sur. 827, dry, TD 505 ft., elev. 1,961 ft., Clear Fork 503 ft.

Ward County: Southern California Petroleum Corp. 1 Reynolds, 14-32-H&TC, dry, TD 2,435 ft., elev. estimated 2,456 ft., Yates 2,255 ft.

TEXAS PANHANDLE (DISTRICT 10) SUCCESSFUL WILDCAT

Hutchinson County: The Texas Co. 1 O. C. Holt, Sec. 66, SM&YS Sur., 1¼ miles S, 10½ miles W of NE corner of county, TD 6,923 ft., elev. 3,213 ft., PB 6,130 ft., PB 6,130 ft., gas pay 6,074-96 ft., IP 1,350,000 cu. ft., RP 1,800 psi.

SOUTHEASTERN NEW MEXICO

Hobbs.—Cities Service Oil Co. 1-AD State, Devonian discovery offsetting the Wolfcamp strike in the Mescalero field, gaged 453 bbl. of 44°-gravity oil on a 5-hour potential test, through 1-in. choke.

Richardson & Bass 1 Cobb-Federal, Delaware Basin wildcat in 23-20s-31e, Eddy County, had 9⅝-in. pipe set to total depth of 9,611 ft. in lime and shale. Projected depth is around 14,500 ft.

See news section for report on Sun Oil Co. and General American Oil Co. of Texas 1 Harper-Federal, a significant indicated discovery on northeastern flank of Delaware basin.

SOUTHEAST NEW MEXICO SUCCESSFUL WILDCAT

Lea County: Gulf Oil Co. 1-AN State, 27-13s-33e, TD 13,440 ft., elev. 4,246 ft., pay 9,580 ft., IP 998 bbl. 43°-gravity oil, ¾-in. choke, TP 200 psi., GOR 984 cu. ft.

SOUTHEAST NEW MEXICO WILDCAT FAILURE

Lea County: Anderson-Prichard Oil Corp. 1 Buffington, 19-25s-38e, dry, TD 3,305 ft., elev. 3,072 ft., Queen 3,150 ft.

Southwest Texas

Tests Indicate Oil Discovery in Kenedy

CORPUS CHRISTI.—Tests in the 1 State Tract 284, Pure Oil Co., wildcat, in Kenedy County, had good indications of oil discovery. Four hours and 50 minutes drill-stem test taken at 7,487-503 ft., on ¾-in. choke, under 558 psi. working pressure, recovered 15 bbl. of 38.6°-gravity oil per hour, and developed bottom-hole pressures open 1,375 psi., closed 2,800 psi. On 24-hour test, recovery was 31.5 bbl. of oil per day. Drill-stem test taken at 7,456-503 ft. showed gas in upper portion of the interval; however, last test was made in oil column, and company will continue to core up to water level. Hole is bottomed to total depth of 7,505 ft.

Western Natural Gas Co. completed its wildcat, 1 St. Charles Bay, State Tract 373, through perforations shot at 8,884-97 ft. indicating production from the 8,900 ft. "J" sand of Frio. Top of pay was called at 8,884 ft. Production completion on open flow, recovered 21,000,000 cu. ft. gas per day, on a ¾-in. choke, flowed 2,085,000 cu. ft. of gas per day under a tubing pressure of 2,020 psi. shut-in pressure of 2,415 psi., on 3/16-in. choke, recovered 1,911,000 cu. ft. of gas per day under a tubing pressure of 2,135 psi. Hole is bottomed to total depth of 10,727 ft., 5½-in. production string was cemented to 10,739 ft., 2⅜-in. tubing was swung at 8,880 ft.

J. L. and R. L. Rush, Dallas operators, have announced new wildcat venture in San Patricio County, to be drilled approximately 4 miles west of Sinton. New venture will be the 1 San Antonio Loan and Trust Co., and is located on the Patrick Fitzsimmons League, A-5.

Hunt Oil Co. has set 5½-in. production casing in the 1 State Tract 91, Aransas Bay, wildcat, approximately 5 miles north of Rockport, Aransas County. Company bottom-hole to total depth of 8,636 ft. and cemented pro-

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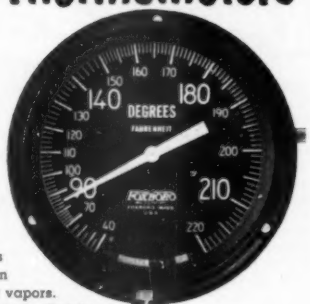

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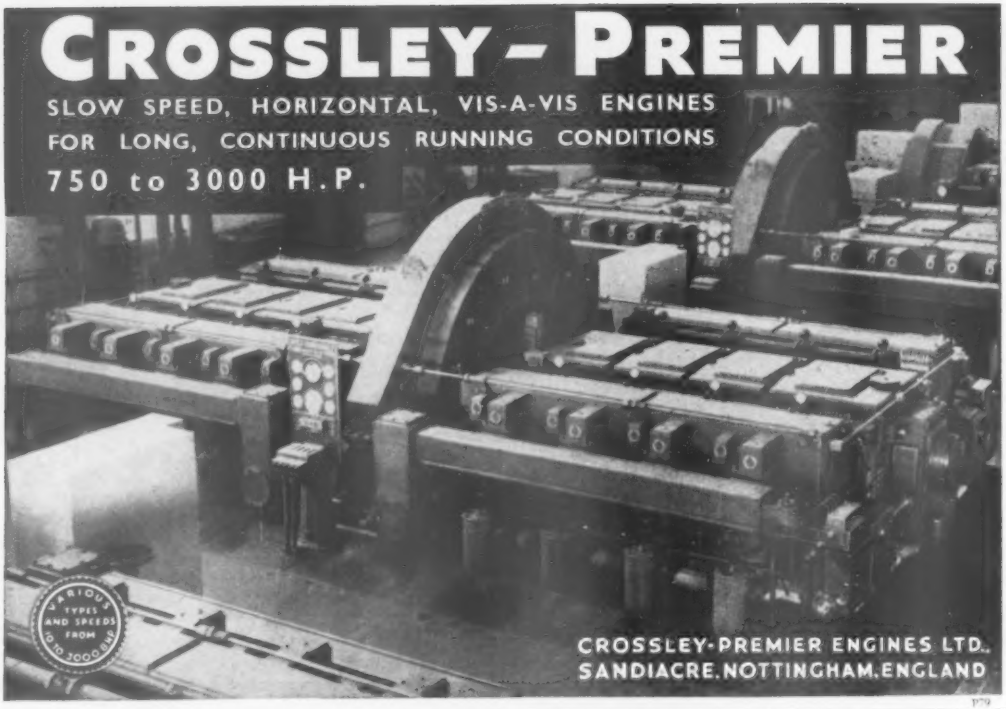

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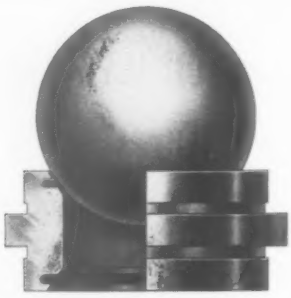

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duction string to 8,363 ft. Location is on the Aransas Bay Tract 91, about 850 ft. southeast of Live Oak Peninsula.

Seventeen miles northwest of Crystal City, Shell Oil Co. has filed application to drill 13,500 ft. wildcat in Zavala County. Venture is to be known as the 1 H. C. Plumley and will likely be drilled to the granite or schist. The importance of this well is that it will provide important geological information of the lower zones in this region. Venture is located on the GC&SF RR Survey 3, A-839.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4)) SUCCESSFUL WILDCATS

McMullen County: Alaska SS & Newman Bros. Drilling Co. AA-5 South Texas Snydicate, BS&F Sur., A-99, TD 6,176 ft., IP absolute open flow, 32,000 M.c.f. per day, Wilcox zone, produced through perf. 5,474-80 ft.

Nueces County: Sunray Oil Corp. 1 State Tract 423, 7 miles S of Port Aransas, TD 7,404 ft., IPF open flow 4,250,000 cu. ft. of gas per day and 30 bbl. of distillate, ¼-in. choke.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) WILDCAT FAILURES

Atascosa County: Forest Oil Corp. 1 A. R. Jennings, C. Masters Sur. 576, A-614, dry, TD 2,400 ft.

Gill-Texita-Palmer 1 J. R. Shock, John Gaston Sur., A-283, dry, TD 1,732 ft.

Sid Katz 2 D. D. Heinen, Carlon Perez Sur., dry, TD 1,607 ft.

Sid Katz et al 1 Maude Cole, Peer MacGreal Sur., dry, TD 2,076 ft.

M. L. Wise et al 1 John E. Hearn, J. M. McCulloch Sur., dry, TD 5,915 ft.

Bell County: I. A. Burr, Jr. et al 1 Bessie Bigdon, A. G. Moore Sur., dry, TD 1,180 ft.

Duval County: Don H. Marsh et al 1 Rafael Garcia Salinas, Santa Cruze de la Concepion Grant, dry, TD 4,703 ft.

The Texas Co. A-2 H. E. Timon, A. Munez Sur., A-1407, dry, TD 5,001 ft.

Guadalupe County: Gasoline Prod. Corp. 1 Stanoley Kubela, Ephrain Bollinsger Sur., dry, TD 1,880 ft.

Jim Hogg County: Randerson, Scoggins & Leiderman 1 Siler Lakes Ranches, Inc., 4½ miles S Hebbronville, dry, TD 4,320 ft.

Tri Mark Oil Co. 3 Julian Vela Pena, El Paynote Grant, dry, TD 1,960 ft.

Jim Wells County: Pontiac Refining Corp. 1 John W. Bird, 2½ miles N. Bentonville, dry, TD 5,618 ft.

Milam County: Wintex Petroleum Co., Ltd., 1 Olga Kosel, W. F. Nelson Sur., dry, TD 2,704 ft.

Nueces County: BKS Garnett & G. E. Sullivan 1 Frederic Nemeo, 6 miles S Corpus Christi, dry, TD 8,715 ft.

San Patricio County: Southern Minerals Corp. 1 M. G. McCampbell, L. Martin Sur., dry, TD 7,219 ft.

Starr County: J. C. McCabe et al 1 Megardo Himojosa, 3 miles NE Rio Grande City, dry, TD 2,520 ft.

Webb County: W. F. Houser 1 D. C. Newton, W. H. Thaxton Sur., dry, TD 1,767 ft.

O. W. Killam 1 O. G. Kirkpatrick, CCSD&RGNG Sur., dry, TD 3,450 ft.

Killam & Hurd 1 W. R. Nicholson, C&M RR Sur., dry, TD 2,129 ft.

Williamson County: Bryan Edwards 1 Joe Bachmayer, C. C. Browning Sur., dry, TD 1,750 ft.

A. C. Schram 1 Walter Eiben, Thomas A. Moore Sur., dry, TD 1,100 ft.

Wilson County: O. G. McClain 1 N. A. Poth, Gasper Flores Grant, dry, TD 6,222 ft.

Louisiana-Ark.

Casing Set at Caddo Test Near Rockpoint

SHREVEPORT.—Midwest Oil Corp. has set casing to 3,785 ft., total depth 3,790 ft., and will "perforate" open hole at 1 Newton Smith, SE NE 22-20n-15w, Caddo Parish wildcat 2½ miles southwest of Rockpoint field, opened earlier this year. Operators are testing a show in 5 ft. of possible pay in the Tooke zone of the Anhydrite Stringer section which is productive at Rockpoint from 3,785-90 ft.

Lion Oil Co. is assured confirmation of its Jeter extension on the north end of Sligo field, Bossier Parish. One well is waiting for state gage and the second well is cased. One-half mile west of 1 Maynard, the extension well, the company is waiting on tests for completion from upper and lower Jeter at 1 Wafer, C SE SE NE 23-18n-12w. Less than ½ mile east and slightly north of the extension, Lion had lime with a gas show from 4,417½-27½ ft. and 4,434½-62 ft.

Arkansas.—Alcan Oil Co. is rigging up pumping unit at 1 Mary Slaughter, wildcat 3¾ miles east of Troy in southern Ouachita County, south-central Arkansas in 14-14s-19w. Oil of 34° gravity is from the Buckrange at 1,962-74 ft.

C. G. Davis Drilling Co. is assured confirmation of their Graves sand discovery in East Pace City field, Ouachita County. Operator is testing 100 bbl. of oil and 100 bbl. of water per day from 2,372-80 ft. at 1 Allen, ½ mile northwest of field opener. Same operator is testing 100 bbl. of oil and 15 bbl. of water per day at 3 Reynolds-Gammill, immediately northeast of the discovery well. Production is from perforations at 2,402-08 ft. at this well in C NW NW SE 28-15s-17w. Southwest of the field discoverer Garland Anthony Oil Co. is swabbing and testing at 1-A Moon, C SW NE NE 32-15s-17w, graves sand test.

LOUISIANA SUCCESSFUL WILDCAT

Catahoula Parish: Hunt Oil Co. and Gulf Refining Co. 70 Louisiana Delta Lumber Co., C SE SW 32-4n-5e, flowed 133 bbl. of oil from Wilcox 6,510-14 ft., TD 6,993 ft. (tentatively called Mittel Lake Southwest).

LOUISIANA WILDCAT FAILURES

Caddo Parish: K&H Operating Co. 1 McDade, 2,010 ft. S and 1,850 ft. W NEc 2-20n-15w, dry, TD 7,512 ft.

Concordia Parish: R. A. Campbell et al 1 Britt et al, 6,000 ft. S and 3,750 ft. W of NEc 11 in Sec. 33-8n-9e, dry, TD 6,206 ft.

Barnett Serio and Gulman and Johns 1 School Section, C SW SE 16-7n-8e, dry, TD 6,517 ft.

Justiss-Mears Oil Co. 2 McGee-Evans, C SW NE 42-6n-9e, dry, TD 7,018 ft.

Hunt Oil Co. and Gulf Refining Co. 5 Angelina Hardwood Lumber Co. "C," C NE SE 28-5n-8e, dry, TD 7,205 ft.

Lincoln Parish: Camco Oil Corp. 1 First National Bank, 590 ft. N and 730 ft. W SEc SW 23-18n-5w, dry, TD 8,002 ft.

Ouachita Parish: W. C. Feazel et al 1 Ouachita Farm Corp., 1,000 ft. N and 524 ft. W of C 10-17n-5e, dry, TD 5,510 ft.

Red River Parish: Alton Coats et al 1 International Paper Co., C SE SE NW 14-13n-9w, dry, TD 3,269 ft.

H. B. Hinton et al 1 Bishop and Can,

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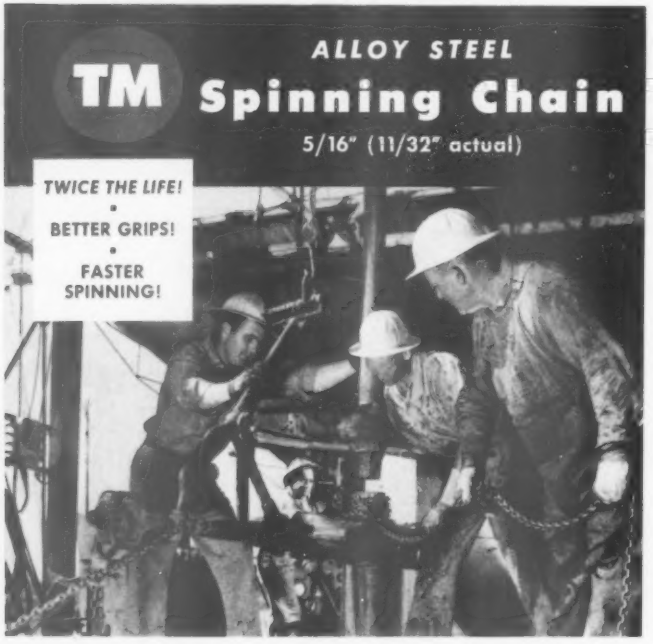

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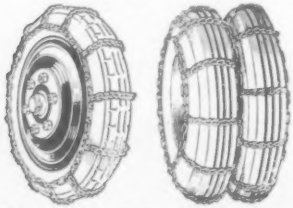

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2,180 ft. S and 1,980 ft. E of NWc 18-11n-9w, dry, TD 7,340 ft.

ARKANSAS SUCCESSFUL WILDCAT

Miller County: Jay Simmons et al 1 Dildy, C N½ SW NW 21-17s-27w, flowed 103 bbl. of oil from Paluxy 4,302-06 ft., TD 4,306 ft. (discovery tentatively named West Foulke).

ARKANSAS WILDCAT FAILURES

Lafayette County: Graham & Morgan 2 USM, 330 ft. N and W SEc NW NE 21-19s-24w, dry, TD 2,777 ft.

Miller County: H. L. Hunt 1 Hanner, 589 ft. S and E NWc SW NE 21-19s-26w, dry, TD 7,251 ft.

Canadian Fields

Possible New Madison Pool Found in Manitoba

CALGARY.—Pascar Oils, Ltd., has found what may be Manitoba's fourth Madison limestone oil pool. The new strike, in the Coulter area, a few miles north of the United States border, came at 2 Pascar on LSD 1, 21-1-27w1. It is 9 miles west-northwest of the Waskada strike, and 15 miles east of the Saskatchewan border. A two hour drill-stem test from 3,201-11 ft., gave up a recovery of about 560 ft. of clean oil, with gravity around 32°. String of production casing has now been set.

Latest swabbing operations at the Socony-Central-Del Rio 1 Ratcliffe well in south central Saskatchewan gave up oil and water, with volume of oil in the fluid ranging only from 1 per cent to 3 per cent. Crew is currently fishing at this well, in an effort to recover a tool that was dropped into the hole.

The 1 Ratcliffe, in LSD 5, 30-1-15w2, 4½ miles north of the U. S. border, gave indications of oil discovery in the Mississippian formation during drill-stem tests last June. This week's swab tests were run in the interval 6,412-33 ft., that was perforated with 126 shots. That section was acidized with 2,250 gal.

During 8 hours of swabbing the well put out 70 bbl. of fluid, of which 3 per cent was oil and 97 per cent water. The well was shut in for 12 hours and then swabbed at rate of 24 bbl. per hour. Of that, 1 per cent was oil, and the balance water. Those perforations have now been squeeze cemented, and crew is fishing for a lost tool.

Tests at the Bailey Selburn Oil & Gas, Ltd.'s Hargrave well in southwest Manitoba give further prospects for commercial oil production.

The indicated discovery well, Baysel-Cal Standard 2-21 Hargrave, on LSD 2, 21-11-27w1, is 6 miles north of Virden oil wells and 50 miles west-northwest of Brandon.

Drill-stem tests in the Madison gave up 32°-gravity oil, and hole was carried down to 2,374 ft. String of 7-in. casing was run to 2,350 ft. and interval 2,330-50 ft. was perforated for production tests. The bottom 24 ft. of hole is also open.

Acid treatment was applied to the formation, and then three acid treatments, totalling 6,000 gal., were carried out. During initial swab tests the well yielded fluid at the rate of 2 bbl. hourly, including 70 per cent oil and 30 per cent acid. On test the following day, the Baysel well flowed for 2 to 3 hours, with product being about 50-50 oil and spent acid. There has been no sign of formation

water. Another 3,000-gal. acid shot was applied over the weekend, and testing operations were to resume.

CANADIAN WILDCAT FAILURES

Imperial 10-1 Ardrossan, LSD 10, 1-53-22w4, TD 3,910 ft.

Texaco A-1 North Bonnie-CPR, LSD 6, 33-47-27w4, TD 7,339 ft.

Long Island 1, LSD 7, 13-61-9w4, TD 1,708 ft.

Jet-Ashmont-Golden 1 Hercules, LSD 4, 20-52-23w4, TD 3,852 ft.

Texaco-Rondee 10-30, LSD 10, 30-46-23w4, TD 5,986 ft.

Northern Development 1 New Concord, LSD 6, 11-29-9w4, TD 3,857 ft.

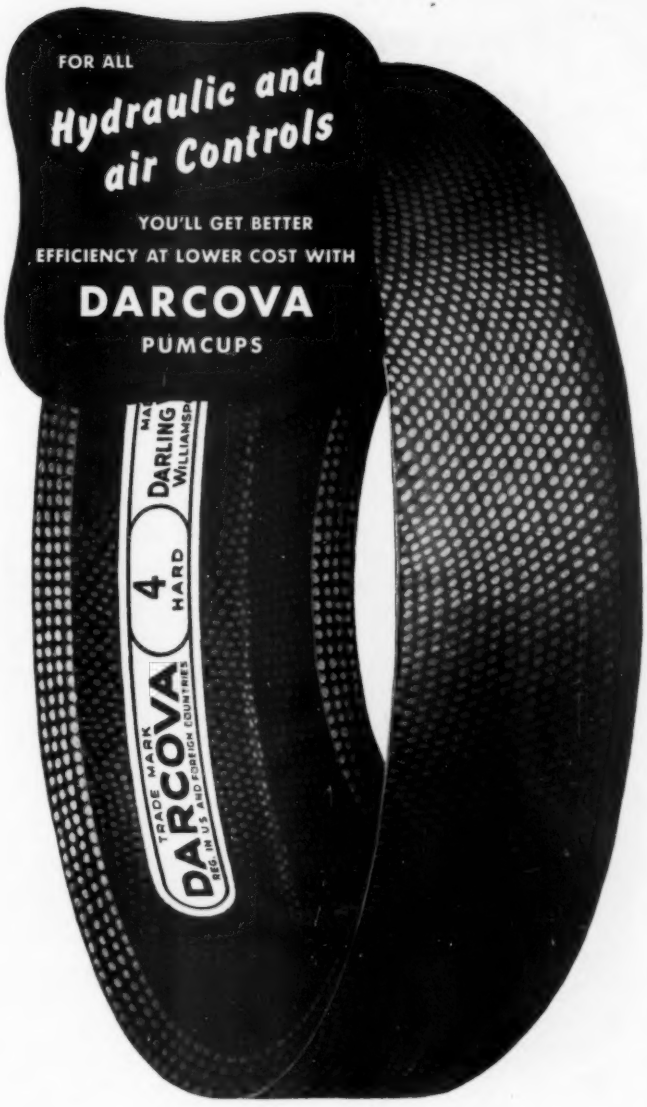
Mississippi

Wilkinson Wilcox Strike Prepares to Complete

JACKSON.—In northern Wilkinson County, Mississippi, approximately 2.6 miles northeast of production at Possum Corner field, the B. Serio-Norman Germany 1 Thaddeus Leak, Section 30-5n-2w, is preparing to install pumping equipment for completion as another Wilcox discovery. This test was drilled to total depth of 7,010 ft. and casing was set to 6,730 ft. to test shows of oil as indicated by cores and log. First test was of perforations 6,703-04 ft. from which the well flowed 20 per cent oil and 80 per cent salt water. A plug was set above these perforations and casing was perforated 6,545-50 ft. to test another zone of the Wilcox. After 95 per cent salt water was recovered, perforations were squeezed and same interval was reperforated. On 1-hour 35-minute drill-stem test using ¼-in. chokes, gas was to surface in 45 minutes and top pressure built up to 14 psi. but the well failed to flow. Tool was then pulled and 4,500 ft. of oil and only 50 ft. of salt water was recovered. It is reported that this sand zone is 13 to 15 ft. thick, but is rather shaly and tight. It is thought that it will make a good pumping well.

The closely watched deep Smackover wildcat on the Sandersville prospect in Jones County, Mississippi, the Gulf Refining Co. 1 Jones County "F," Section 16-9n-10w, has had rather discouraging results from drill-stem test during the past week. It will be recalled that top of Smackover was encountered at 12,704 ft. and 7-in. casing was set at 13,091 ft. Hole was then cored to total depth of 13,161 ft. in salt. First drill-stem test was of open hole below casing with recovery being only 60 ft. of gas-cut mud. A bridge plug retainer was set at 13,088 ft. and casing has now been perforated 12,974-982, 12,992-13,052, 13,060-66, 13,074-86 ft. Recovery from a drill-stem test of these perforations was only 20 ft. of rat hole mud in addition to the water cushion. Bottom-hole flowing pressure was zero. Operators are now preparing to treat the well with acid.

The Paleozoic area of northeast Mississippi, received another slight bit of encouragement this past week when the Shell Oil Co. 1 Mrs. Lee Harrington, Section 25-14s-6e, Monroe County, encountered a show of oil. Drill-stem test was run at 1,928-45 ft. using ⅜-in. bottom and ¼-in. top chokes. Tool was left open 1 hour and 5 minutes. Recovery was 30 ft. of mud slightly cut with gas and oil. Bottom-hole pressure was only



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MISSISSIPPI SUCCESSFUL WILDCAT

Adams County: Humble Oil & Refining Co. C-1 N. H. Breaux et al, Sec. 11-4n-3w, TD 7,300 ft., flowed 75 bbl. of oil per day, ¼-in. choke, 46° gravity

MISSISSIPPI WILDCAT FAILURES

Adams County: Sinclair Oil & Gas Co. 4 Hogue Est., Sec. 18-5n-4w, dry, TD 6,995 ft.

Jefferson County: G. A. Clements-Lyle Cashion Co. 1 Abe Ellis, Sec. 27-8n-1e, dry, TD 6,520 ft.

Lincoln County: D. A. Biglane-Dorris Ballew 1 J. W. Jordan, Ses. 15-5n-6e, dry, TD 11,252 ft.

ALABAMA WILDCAT FAILURE

Monroe County: Mobile Drilling Co.-S. P. Borden 1 R. B. Williams, Sec. 25-8n-5e, dry, TD 4,516 ft.

Texas Gulf Coast

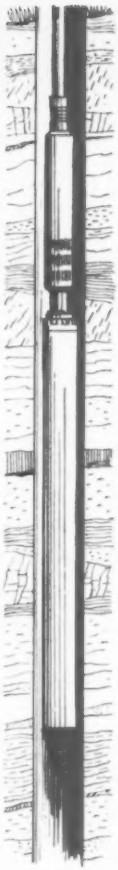
Production String Set At Fort Bend Wildcat

HOUSTON.—Approximately 1 mile west-northwest of the nearest oil production in Fulshear field, Fort Bend County, Sunray Oil Corp. has cemented 5½-in. production string on bottom at 7,812 ft. in the 1 Clyde Nelson, projected 8,500-ft. wildcat test. After running electrical survey at 7,812 ft. sidewall samples at 7,434-37-45-97 and 7,696 ft. all indicated oil odor and cut pale blue fluorescence was made at 7,542 ft., and sand at 7,490-699 ft. had no show. Well is located on the George W. Cartwright Sur., A-149.

Three miles southwest of Bay City in the South Lucky area of Matagorda County, Commercial Petroleum & Transport Co. has moved up the hole for tests in 1 Marcus D. Huebner, after testing flow of 25 per cent oil through perforations at 3,435-45 ft. The apparent new pay discovery and was flowing at the rate of 110 bbl. of fluid per day on ¼-in. choke with tubing pressure of 650 psi., 5 per cent salt water, and 24.6°-gravity oil. Well is located on the Peter Bertrand Survey, A-5.

After having reached a total depth of 6,501 ft. at their 1 Espiritu Santo Bay State Tract 201, wildcat, Calhoun County, Humble Oil & Refining Co. have been running completion tests which revealed 23,500,000 cu. ft. of gas per day. Operators were ready to complete but pressure declined to the extent that it will be necessary to Stratafrac in order to bring gas pressure back up. Possible recovery was effected on ¼-in. chokes. Also on test small amount of 45.1°-gravity distillate was recovered with tubing pressure recorded 1,600 psi. Well is located on the Espiritu Santo Bay Survey, 11 miles southwest of Port O'Connor.

In Finfrock field, Harris County, The Texas Co. has failed to confirm oil production but finaled completion of 3 H. D. Taylor as a gas-distillate well. Although perforations were not immediately available, well flowed 110 bbl. of fluid, 87 per cent salt water, to produce 14.3 bbl. of distillate and 1,045,000 cu. ft. of gas per day on test. Hole was made to 8,010 ft. and 5½-in. production string cemented at 7,868 ft. Previously drill-stem test in open hole with packer at 7,107 ft., ¾-in. chokes and tool open 10 minutes, well developed working pressure at the surface of 350 psi. in 7 minutes. Recovery was



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water cushion cut with gas and distillate. A firm fine grained sand with fair gas odor and salty taste was cored 7,050-110 ft. and at 7,115-16 ft. recovery was firm, fine grained sand with salty taste, no odor or fluorescence. Location is on the H. D. Taylor Survey, A-470.

TEXAS GULF COAST (DISTRICTS 2 AND 3) WILDCAT FAILURES

Bee County: Southern Minerals Corp. 1 Mangus Beck, J. R. Johnson Sur., dry, TD 7,215 ft.

Fayette County: Ryan, Hays & Burke 1 Marcella Janda, David Berry Sur., dry, TD 4,026 ft.

Goliad County: Geo. H. Coates 1 Sophie Heller, H. C. Kitchen Sur., dry, TD TD 4,102 ft.

Liberty County: Liberty Work-Over & Drilling Co. 1 Dunn-Myers-Atkinson, Reason Green Sur., dry, TD 9,611 ft.

Refugio County: Kirkwood & Morgan, Inc. 1 R. M. Dammann, J. M. & M. Aldrete Grant, dry, TD 5,647 ft.

Tri-Mark Oil Co. 1 Mary Ellen Fox, John Coughlin Sur., dry, TD 6,020 ft.

Tyler County: Humble Oil & Refining Co. 1 Warren gas unit, BBB&C Sur., dry, TD 10,342 ft.

Washington County: H. J. Chavanne, Trust 1 Robert H. Brauner, Henry Austin Sur., dry, TD 9,206 ft.

Wharton County: John B. Coffee 1 G. N. Rauscher, BS&&F Sur., dry, TD 8,617 ft.

South Louisiana

Gas-Distillate Strike Assured for Acadia

NEW ORLEANS.—In the West Church Point area, Acadia Parish, Union Sulphur & Oil Corp. is assured of a new gas-distillate discovery at its 1 Dewey M. Harmon et al. On 3¼-hour dril-stem test, ¼-in. by 10/64-in. chokes, well flowed unestimated amount of distillate plus an estimated 1,500,000 cu. ft. of gas daily under 2,950 psi. of working pressure. Final shut-in pressure was 3,000,000 cu. ft. of gas plus 25 to 30 bbl. of distillate daily under 2,600 psi. of tubing pressure. Hole is bottomed at 11,208 ft. with 5-in. casing cemented at 10,305 ft. Casing was perforated at 10,235-240 ft. zone for the test. Location is in Section 51-7s-2e.

Sun Oil Co. has cemented 7-in. casing at total depth of 10,648 ft. at the 1 E. Pousson, wildcat in the Northwest Eagan area, Acadia Parish, and is now waiting on cement before continuing operations. Prior to setting casing, survey was run to 10,649 ft. but results have not been reported. Location is on Section 18-9s-1w.

Flowing at the rate of 120 bbl. of 42°-gravity oil through 36-in. by ¼-in. chokes, Kemp Drilling Co. is continuing to test its 1 Fisher, oil discovery in Avoyelles Parish. Tested through perforations 7,403-05 ft., in the Wilcox sand, discovery flowed under 650 psi. working pressure. Prior to running drill-stem test operator block squeezed the sand through perforations at 7,399-400 ft. and 7,413-14 ft. Location is on Section 34-3n-5e.

Ted Weiner, independent operator of Fort Worth, has staked location on a 11,500 ft. test known as the 2 Wylie, 7 miles southeast of Houman, Terrebonne Parish. New venture is located in Section 89-17s-16e.

F. Kirk Johnson, Fort Worth operator, has abandoned the 1 Bently Lumber Co. after failure to recover shows of commercial value from survey to 7,810 ft. Failure is located in Section 4-4n-4w.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

Vermilion Parish: Austral Oil Exploration Co. 1 Vincent & Welch, Sec. 12-13e-2w, TD 13,803 ft., IPF 88 bbl. of oil per day plus 4,400,000 cu. ft. of gas per day ¼-in. choke, 47.5° gravity

SOUTH LOUISIANA WILDCAT FAILURES

Acadia Parish: Humble Oil & Refining Co. 1 Mrs. Jeanette R. Haas et al, Sec. 7-7s-2w, dry, TD 9,310 ft.

Cameron Parish: Humble Oil & Refining Co. 1 Miami Corp. "L," Sec. 19-12s-8w, dry, TD 9,200 ft.

Rapides Parish: Carter Oil Co. 1 South Catahoula Lake, Sec. 32-6n-3e, dry, TD 5,941 ft.

Appalachian-Ohio

Salt Sand Oil Well Reported In Calhoun County District

PITTSBURGH.—In Garrett County, Maryland, Superior Oil Development Co. 1 Wilt & Jacobs, resulted in a dry hole; Tully 3,737 ft., Onondaga 4,474., chert 4,821 ft., Oriskany sand 4,882 ft., salt water 4,885 ft., TD 4,885 ft., Eberly & Snee 1 McCullough heirs is drilling at 6,451 ft., and 1 Ross Liehty at 3,405 ft., and W. H. & A. A. Rader 1 Pleasant Valley Church is at 3,685 ft., Columbian Carbon Co. 1-1510 D. Milton Riley is shut down at a depth of 3,921 ft., to acidize.

West Virginia.—In Lee district, Calhoun County, West Virginia, E. W. Grimm, completed 2 E. T. Powell, with a daily initial of 50 bbl., in the Salt sand, TD 1,738 ft. Logan district, Logan County, Hope Natural Gas Co. 9715 Boone County Coal Corp., is shut down at 5,431 ft., Oriskany sand 5,400-28 ft. This well will be shot in the Brown shale and Berea sand. Anthony Creek district, Greenbrier County, Natural Resources Corp. 1-1 T. M. Van Buren heirs, elevation 2,122 ft. has resumed drilling and is at a depth of 1,526 ft. Huttonsville district, Randolph County, Snee & Eberly 2, West Virginia Board of Control, elevation 2,069 ft., is drilling at 3,005 ft.

Pennsylvania. — Unity Township, Westmoreland County, Southwest Pennsylvania: Peoples Natural Gas Co. 4003 A. J. Dotterway, is drilling at 8,476 ft., and 4008 J. R. Frola, at 8,273 ft.

MARYLAND WILDCAT FAILURE

Garrett County: Superior Oil Development Co. 1 Wilt & Jacobs, dry, Tully 3,737 ft., Onondaga 4,474 ft., chert 4,821 ft., Oriskany sand 4,882 ft., salt water 4,885 ft., TD 4,885 ft.

OHIO

Swingle Oil & Gas Co. has drilled a third nice gasser in the new pool in eastern Newton Township, Muskingum County, 1 C. A. Lambert, Section 22. Clinton sand was topped at 3,477 ft. and drilled in to 3,501 ft., where the open flow is 1,760,000 cu. ft. The operator is undecided about drilling through the sand at the present time.

Bebout et al. 1 Donald Gillett, Lot 15, Willington Township, Lorain County, is still out of control. The gas caught fire and destroyed the rig and another machine was moved on the location, and is attempting to land 5⅞-in. pipe.

B. H. Putnam et al. 2 L. O. Williams, River lot, Belpre Township, Washington County, topped the Injun sand at 1,374 ft. and drilled 2 ft. in with an open flow of 750,000 cu. ft. natural.

California

New Deep Eocene Test Being Rigged Up in Kern

LOS ANGELES.—A new wildcat which may go to 18,000 or 20,000 ft. in search of Eocene production was being rigged up by Richfield Oil Corp. in North Coles Levee field in Kern County. The test, 67-29 C.L.A., was being prepared in SW 29-30s-25e, in the northwestern portion of the field.

Deepest Coles Levee test drilled to date was Standard Oil Co. of California 13 Kern County Land-20x in 5-31s-25e. It was abandoned at 16,246 ft., still in the lower Miocene. The new deep test is about 10 miles northwest of that of Ohio Oil Co. in Paloma field. Also searching for Eocene, or lower Miocene production, the latter has reached a depth of about 16,000 ft.

Two new oil discoveries were added in Kern County fields. About ¾ mile northwest of Bellevue production Standard of California 53 Karpe was completed pumping 95 bbl. of 30°-gravity crude from perforations at 8,790-8,810 ft. Production was from a lower Stevens sand, encountered after finding the top of the section gray.

In South Midway, 16-32s-23e, Oceanic Oil Co. completed 1 General American as a 150-bbl. pumper to establish first Republic sand production in that section. Drilled to 4,371 ft., production was obtained through perforations at 4,312-30 ft.

In Guijarral Hills field near Coalinga, Fresno County, a second Eocene zone test shortly will be started by Standard of California. Located in NE 22-20s-16e, 51 Guijarral Service Co. is about 1½ miles north of Guijarral Hills and a similar distance east of Pleasant Valley production. The new test is expected to go to a depth of approximately 11,000 ft.

About 3 miles south of the announced test Sunray Oil Corp. was drilling below 11,440 ft. at 41-19 Dessel, idle for the past 2 years after the Allison sand was found missing. The revived test was drilled deeper from 10,065 ft.

A development in the northern counties gas area was the completion of a gas well 2 miles east of Eureka field in Humbolt County. The successful producer, The Texas Co. 1 Little-A, on a 6-hour test flowed at the daily rate of 2,500 M.c.f. Production was through perforations at intervals between 5,460-5,795 ft.

In San Joaquin County, Union Oil Co. was grading location for a wildcat between Galt and Lodi gas fields. Site of the test, 1 Union-Brazos-Grussendorf, is in NE 2-4n-7e, about ½ mile from either area. According to scout reports a new Solano County wildcat will be that of Humble Oil & Refining Co. in 12-7n-2e, north of Dixon gas field. Reported planned depth was 13,000 ft.

CALIFORNIA WILDCAT FAILURES

Butte County, Princeton area: Union Oil Co. 14-18 Union-Brazos Scammon, 18-17n-2e, dry, TD 4,013 ft., elev. 78 ft.

Fresno County, San Joaquin area: R. Giffen

1 Giffen, 8-16s-16e, dry, Kreyenhagen 7,441 ft., Domengine 8,030 ft., TD 9,000 ft., elev. 207 ft.

Kern County, Fruitvale area: Stansbury-Webb 17-24 KCL, 24-29s27e, dry, TD 4,689 ft., elev. 410 ft.

Salt Creek area: Intex Oil Co. 57X Anderson Two, 19-29s-21e, dry, Phacoides 2,620 ft., Carneros 1,290 ft., TD 2,625 ft., elev. 1,147 ft.

Ten Section area: Kern County Land Co. 81-5 KCY, 5-31s-26e, dry, TD 8,681 ft., elev. 330 ft.

Los Angeles County, Liberty Canyon area: Shamel & Draucker, Operators 1 Steele, 36-1n-18w, dry, Volcanics 1,900 ft., TD 2,572 ft., elev. 775 ft.

Little Rock area: J. E. Willette 1 Chief Paduke, 24-5n-11w, dry, TD 1,450 ft., elev. 3,200 ft.

Monterey County, Monroe area: The Texas Co. 1 Beedy B (NCT-1), 34-19s-7e, dry, TD 3,354 ft., elev. 673 ft.

Sacramento County, Freeport area: Standard Oil Co. 1 Corriea, 24-7n-4e, dry, TD 7,490 ft.

San Joaquin County, East Islands area: Amerada Petroleum Corp. 1 Powell Core Hole, 25-4n-4e, dry, TD 4,821 ft.

San Luis Obispo County, Paso Robles area: Fairco Drilling & Development Co. 1 Peterson 19-27s-12e, dry, TD 800 ft., elev. 1,200 ft.

Santa Barbara County, Cuyama Valley area: Superior Oil Co. 1 Cuyama Government, 21-9n-26w, dry, TD 10,053 ft., elev. 3,311 ft.

Solano County, Maine Prairie area: Amerada Petroleum Corp. 1 Gunning, 34-6n-2e, dry, TD 7,546 ft.

North-Central Texas

Grayson Well to Recomplete In Deeper Horizon

WICHITA FALLS.—Recompletion as a discovery from a deeper horizon was in line for Standard Oil Co. of Texas 1 W. H. Baker, Grayson County Ordovician discovery about 2 miles northwest of Sherman.

The well was first completed at 9,427 ft. and operators moved in to drill ahead when production declined. Last week, on a 23-minute drill-stem test of the Joines limestone at 10,547-80 ft., recovery was 15 ft. of oil and 45 ft. of oil-cut mud. Operators were running electrical surveys. Tops reported included the Oil Creek sand at 10,469 ft. and the Joins at 10,528 ft. Elevation is 800 ft.

Other Grayson County wildcat activity included: Humble Oil & Refining Co. 1 Williams, 3 miles northwest of Sandusky, drilling shale and sand at 10,125 ft. Magnolia Petroleum Co. 1 Godwin, J. Coryell Survey, drilling below 7,000 ft. Flaitz and Mitchell 1 Kay Kimbell, W. C. Athison Survey, drilling below 3,792 ft., and Star Oil Co. 1 W. A. Moser, southeast of Pottsboro, was drilling shale at 4,850 ft.

In Montague County Jack Grace Production Co. 1 H. J. Ray, conglomerate discovery 3 miles southwest of Stoneburg, flowed 294 bbl. of oil in 10 hours, through 24/64-in. choke from pay at 6,023-33 ft., on completion test. Total depth was 6,181 ft.

George S. Engle has located 1 Ray Wines in the F. Escobar Survey, A-216, 5½ miles west of Illinois Bend, in Montague County. Projected depth was 5,000 ft.

Callahan County had a new producing area at Cities Service Oil Co. 1 Johnson, 1½ miles southeast of Oplin. After swabbing in, the well kicked off to flow 179 bbl. of oil in 35 hours through ¼-in. choke. Pay sand was perforated from 3,663-73 ft.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) SUCCESSFUL WILDCATS

Baylor County: J. J. Lynn 1-H Cowan, Sec. 207 T&NO, 12 miles NE Seymour, TD 4,723 ft. elev., 1,304 ft., pay 4,717 ft., IP 154 bbl. 40°-gravity oil, 16/64-in. choke, IP 210 psi., GOR 485 cu. ft.

Grayson County: H. L. Hunt 1 Swafford, J. B. McAnair Sur., TD 4,357 ft., elev. 807 ft., pay 4,304 ft., IP pumped 136 bbl. 40°-gravity oil.

Jones County: Great Lakes Carbon Corp. 1 Delia Gill, 21-2-SPRR, TD 4,754 ft., elev. 1,814 ft., pay 4,634 ft., IP 460.6 bbl. 40°-gravity oil, 16/64-in. choke, TP 400 psi., GOR 500 cu. ft.

Ungren & Frazier 2 Jane Hoyt, 20-15-T&P, 5 miles NW Hawley, TD 2,227 ft., elev. 1,715 ft., Bluff Creek pay 2,217 ft., IP pumped 72 bbl., 27°-gravity oil.

Stonewall County: American Trading & Producing Co. 1 Herman Letz, Nannie Craft Sur., A-464, 3 miles NE Old Glory, TD 6,501 ft., elev. 1,596 ft., pay 5,954 ft., IP pumped 59 bbl. 37°-gravity oil.

Wise County: A. C. Dillard 1 B. F. McKay, Sec. 3, Falls CSL, TD 6,030 ft., pay 5,733 ft., IP 27 bbl. 40°-gravity oil, ¼-in. choke, TP 350 psi., GOR 750 cu. ft.

NORTH CENTRAL TEXAS (DISTRICTS 9 and 7-B) WILDCAT FAILURES

Archer County: W. F. Bockhoff Trust 1 Ed White, Blk. 3, W. E. Probert Sur., dry, TD 1,424 ft.

Dublin-Kiel 1 Mangold Est., Blk. 8, Mangold Subd., dry, TD 1,860 ft.

Tom Medders and E. B. Clark 1 G. J. Forcher, 13-1-H&TC, dry, TD 5,506 ft., Caddo 5,317 ft.

Miller & Banks 1 W. B. Ray, W. C. Winters Sur., A-663, dry, TD 1,513 ft.

Brown County: Connally-Jackson 1 Hattie Yarbrough, Blk. 93, G. W. Petty Sur., dry, TD 825 ft.

Coleman County: Dal Tex 2 Floyd Price, Sec. 46, T&NO, dry, TD 1,870 ft., elev. 1,608 ft., Fry sand 1,707 ft., Gardner 1,830 ft.

F. Kirk Johnson 1 R. D. Holt, 668-6-M. D. J. Trevine Sur., dry, TD 2,355 ft.

Robinson-Puckett, Inc. et al 1 L. H. Vaughn, Sec. 5, J. V. Massey Sur., dry, TD 4,160 ft., elev. 2,001 ft., Fry 3,489 ft., Caddo 4,053 ft.

Robinson-Puckett 1 Lucy Cox, Sec. 238, E. J. Boudzand Sur., dry, TD 2,600 ft.

Robinson-Puckett 1 M. Jamison, Sec. 1, Waco M. Co. Sur., dry, TD 2,504 ft.

Cooke County: Carl Sewell 4 J. G. Jones, J. Arrocha Sur., dry, TD 2,635 ft.

Carl Sewell 1 J. C. Reeves, A. G. Harris Sur., dry, TD 2,380 ft.

Eastland County: Garr Oil Co. 1 Ed O'Rear, Sec. 3, T&NO, dry, TD 2,981 ft.

Haskell County: T. D. Humphrey 1 John Stewart, Geo. W. Brooks Sur., A-21, dry, TD 5,439 ft., Palo Pinto 3,435 ft., Mississippian 5,400 ft.

J. C. Hunter Jr. 2-F Pardue, 8-5-H&TC, dry, TD 3,742 ft.

Jack County: S. D. Johnson 1 F. C. Bloodworth, J. F. Chearis Sur., A-149, dry, TD 4,757 ft.

Knox County: Stanolind Oil & Gas Co. 1 J. A. Dunman, 91-2-D&WRR, dry, TD 5,025 ft.

Montague County: O. E. Hall 1 C. E. Quillen, F. J. Bellow Sur., A-32, dry, TD 6,485 ft., Barnett 6,465 ft.

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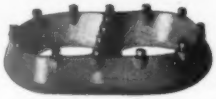

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WICHITA FALLS, TEXAS

Nolan County: Wilshire Oil Co. and British American Oil Co. 24 Roy Spires, 183-1A-H&TC, dry, TD 7,325 ft., elev. 2,461 ft., Strawn 7,070 ft., Ellenburger 7,300 ft.

Taylor County: Lion Oil Co. 1 Hamilton, 29-16-T&P, dry, TD 2,700 ft.

Throckmorton County: Giddens & Shriver 1 Thornton, Sec. 91, TE&L, dry, TD 4,702 ft., elev. 1,248 ft., Palo Pinto 4,672 ft. T. D. Humphrey 1 C. P. Baker, Blk. 98, C. Winters Sur., A-430, dry, TD 5,502 ft.

Wichita County: E. H. Pigg 3 E. H. Pigg-Case, Sec. 831, TE&L, dry, TD 1,920 ft.

Wilbarger County: A. L. Andree 1 Roy Abbot, 35-16-H&TC, dry, TD 2,657 ft. Frank Wood Associates, Inc. 1 Brown Castleberry, 98-14-H&TC, dry, TD 3,436 ft. Frank Wood 1 W. T. Waggoner "Hart," 47-2-H&TC, dry, TD 2,555 ft.

Young County: Harry F. Snebold 1 Allar Co., Sec. 1, BS&F Sur., A-44, dry, TD 2,701 ft.

Eastern Texas

Operator to Rework Old Harrison Wildcat

DALLAS.—Bert Fields was reported planning to reenter an abandoned wildcat 6 miles southwest of Tatum in Harrison County, to test around 7,000 ft. The well is 1-A B. C. Purse, Daniel Martin Survey, which had old total depth at 7,300 ft.

Humble Oil & Refining Co. 1 Henry Hygh, south of Karnack in Harrison County, continued coring in shale below 6,450 ft. Last reported shows were cored between 6,003-53 ft., where recovery was 50 ft. of limestone bleeding distillate. A test at 6,013-53 ft. developed 90 ft. of gas-cut mud and 120 ft. of oil and salt water-cut mud.

A new sand pay was in prospect for the north side of Wortham field in Freestone County at W. A. Reiter 1 Mrs. R. V. Bounds. Nacatoch sand from 952-67 ft. apparently had good oil shows and the well was shut in for storage tanks.

In Henderson County E. B. Fletcher 1 J. C. McNair, wildcat 5 miles southwest of Mabank, called top of the Woodbine sand at 3,139 ft., and was drilling ahead below 4,000 ft.

Hunt Oil Co. 1 Wakefield, Woodbine wildcat north of Midway in Leon County, was drilling below 7,722 ft. in chalk, shale and lime.

Three States Natural Gas Co. 1 Reynolds, projected 7,600-ft. Travis Peak wildcat 5 miles southeast of Thornton, Limestone County, was drilling below 4,630 ft.

EAST TEXAS (DISTRICTS 5 AND 6) SUCCESSFUL WILDCAT

Harrison County: Le Cuno Oil Co. 1 T. J. Taylor, John Bland Sur., A-187, 4 miles SE Leigh, TD 6,337 ft., elev. 2,666 ft., Travis Peak 5,950 ft., perforated 6,102-07 ft., IP 40 bbl. 48°-gravity oil and 1,950,000 cu. ft. of gas.

EAST TEXAS (DISTRICTS 5 AND 6) WILDCAT FAILURES

Anderson County: Olsan Bros., Inc. 1 W. A. Jorda, S. W. Perry Sur., A-646, 2½ miles NW Palestine, dry, TD 5,500 ft., Woodbine 5,440 ft.

Bowie County: Coats & Moore 1 Lumpkin, J. W. Womble Sur., A-661, 2½ miles SW Dalby Springs, dry, TD 4,635 ft.

Kaufman County: Rose Drilling Co. 1 L. B.

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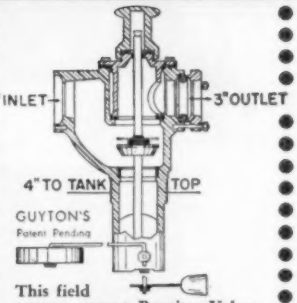

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Hill, J. S. Ables Sur., 2 miles NE Kemp, dry, TD 3,530 ft., Woodbine 2,988 ft.

Shelby County: Trans-American Petroleum Corp. 1 Hurst, Z. C. Walker Sur., A-757, 2½ miles SE Center, dry, TD 7,516 ft., elev. 312 ft., Glen Rose 4,835 ft., Massive anhydrite 5,515-5,720 ft.

Rocky Mountain

Deeper Zone Tests Oil At Roosevelt Wildcat

DENVER.—A second zone at the C. H. Murphy, Jr., apparent discovery northwest of East Poplar field in Roosevelt County, Montana, has tested oil at the rate of 28 bbl. per hour, following the pattern of success so far established in the field proper. The wildcat is 10 Unit, C SW NW 30-29n-51e, 4 miles northwest of the field discovery.

Tests last week recovered apparently commercial quantities of oil from the interval 5,460-75 ft. Current tests were in the zones 5,606-19 ft., and 5,626-40 ft. In the first zone gas flowed at the surface after 14 minutes, oil after 194 minutes, with the flow open for 15 minutes at the estimated 28 bbl. per hour rate. The operator then reversed out clean oil and 136 ft. oil-cut mud with a like amount of salt water. Flowing pressure was 350-1,750 psi. In the second interval the flow at the surface began after 160 minutes, and reverse circulation produced clean oil, with 30 ft. of mud, 61 ft. of oil and gas-cut mud, and 182 ft. of salt water. Flowing pressure was 800-2,225 psi.

Total depth of the wildcat is 5,787 ft. with the operator preparing for further testing.

Tops have not been released on the discovery, but production in East Poplar field has been from two Mississippian zones which correlate generally with those tested at the new producer.

The first major development in the general Richey area of McCone County since the discovery of oil there more than a year came in the test of apparently commercial quantities of oil from Shell Oil Co.'s 21-33-B-NP, C NE NW 33-22n-48e, about 12 miles southwest of the Richey discovery, in McCone County. The operator tested the interval 9,086-9,145 ft. and after 2½ hours open time reverse circulation produced 6,700 ft. of gas oil, with flowing pressure 600-1,375 psi.

The well is about 2 miles southwest of Shell's suspended venture in the Duck Creek area. It is apparently a new pool opener, and is believed also to be a new pay discovery for the general area. Tops have not been officially released but the discovery is unofficially credited to Devonian formations. Previous production in the Richey area has been from Mississippian zones, at a shallower depth. The tested interval at the southwest Richey discovery is comparable to that which produces from Devonian (?) in the Cedar Creek area to the southeast. Shell is running surveys on the wildcat, with total depth at 9,145 ft.

A new discovery and a possible new pay zone is being tested in the Sand Creek area, northwest of Cedar Creek proper in Dawson County. This area is one of four formerly lumped all together under the general Cedar Creek designation.

Williston Oil & Gas Co. recovered 900 ft. of heavily oil-cut mud, 900 ft. of mud-cut oil, and 2,880 ft. of salt water from the interval 8,992-9,013 ft. in the 1 Government, C NE NE 14-15n-54e. Tool was open 2 hours, flowing pressure 200-1,900 psi. Test was believed in Silurian, which has not been established officially as a producing horizon in the Cedar Creek trend.

In Carbon County, Montana, Cities Service Oil Co. is testing a possible Tensleep discovery at 1 Government, C NW SW 33-6s-21e, in the Dry Creek area. This is one of a series being drilled by this operator through the general south-central Montana area. The well made 90 ft. of oil and 132 ft. of slightly mud-cut oil, and 100 ft. of oil-cut mud. Oil recovered was 35° gravity, and flowing pressure was 40-137 psi. Cities Service will core ahead from 8,004 ft. for further tests.

In the Nine Mile area of Big Horn County, George Greer, Dallas independent has completed the discovery in Snyder field for 150 bbl. of oil per day, an estimated gage. The well is 2 Kendrick, NE NW NW 6-1s-35e, and production is from Tensleep, with the well considered of much importance to the Montana portion of the Powder River basin.

New tests at Carter Oil Co.'s Walker Hollow, Uintah County, Utah wildcat have established the well as a definite discovery of the east side of the Uinta basin. The well is 1 Johnson, SW SW 8-7s-24e (SLM), and two drill-stem tests this week bore out earlier commercial indications. Test from 5,424-81 ft. made 5,338 M.c.f.g.p.d. gas daily. From 5-511-44 ft. the recovery in 2 hours was 1,900 ft. of gas-cut 26°-gravity oil. Test 5,550-5,603 ft. made 4,310 ft. of gas-cut 31°-gravity oil. Carter is preparing for further tests with total depth at 5,657 ft.

Two Nebraska discoveries are testing in the Denver-Julesburg basin portion of the state. Ohio Oil Co. tested gas from both "D" and "J" sands at 1 Spicknal, NW NW NE 10-13n-50w, Cheyenne County. Flow from "D" at 4,613-23 ft. was 3,430 M.c.f.g.p.d. gas daily. From 4,758-66 ft. the maximum

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blow was 2,100 M.c.f.g.p.d. gas daily. Ohio is coring ahead below 4,674 ft. The wildcat is 1½ miles northeast of an Ohio gas discovery made in 1950.

Stanolind Oil & Gas Co. reported recovery of oil on test of the 1 State, SE NE SE 16-12n-55w, in the Longfield area of Kimball County. The well made 3,032 ft. of oil and 140 ft. of oil and gas-cut mud in 4-hour test of the interval 6,107-33 ft. with "D" sand topped at 6,099 ft.

Two Washington County, Colorado wildcat discoveries are in completion stages. Amerada Petroleum Corp. is finaling the 1 Sharp, NE SE SW 26-1s-55w, at a pump gage of 20 bbl. daily from "D" sand. This is one of a current series of stratigraphic tests through the area by Amerada. R. L. and J. L. Rush are swabbing 120 bbl. of 22°-gravity oil per day from 1 Jones, SE SE NW 25-3s-55w, also from the "D" sand. This well is a farmout from Amerada, one of three made to these operators as a part of the series referred to above.

WYOMING WILDCAT FAILURES

Albany County: Pacific Western 1 Strom, NW NW SE 32-15n-76w, dry, TD 4,664 ft.

Johnson County: Ray Hose et al 2 Government, SW NE SW 31-41n-79w, dry, TD 1,263 ft.

Park County: Pierce Well Service 1 Government, Lot 9, Sec. 7-53-102w, dry, TD 650 ft.

Sweetwater County: Cities Service Oil Co. 1 Union Pacific, C NE NE 35-19n-102w, dry, TD 8,624 ft.

Seaboard Oil Co. of Delaware 55-14-G, NE NE SW 14-26n-90w, dry, TD 7,164 ft.

COLORADO SUCCESSFUL WILDCAT

Washington County: Amerada Petroleum Corp. 1 Bertha Sharp, NE SE SW 26-1s-55w, pumped 20 bbl. of oil per day from "D" sand 4,746 ft., new field, TD 5,224 ft. PBTD 4,794 ft.

COLORADO WILDCAT FAILURES

Logan County: Tuley & Carter 1 Stinson, SE SE SW 12-7n-51w, dry, TD 4,825 ft.

Bay Petroleum Corp. 1 Bonham, SW SW SE 22-8n-55w, dry, TD 5,536 ft.

Phillips County: Sunflower State Oil Co. 1 Charles Fuelcher, C SW 10 acs. 3-8n-44w, Lot 5, dry, TD 3,450 ft.

Washington County: Plains Exploration Co. 1 Bushner, NW NW SE 11-4n-49w, dry, TD 4,374 ft.

Amerada Petroleum Corp. 1 Hock, NW SW NE 13-1s-50w, dry, TD 4,536 ft.

Amerada Petroleum Corp. 1 Kjellrup, SW NE NE 33-1s-54w, dry, TD 5,138 ft.

Hanco Oil & Gas Co. 1 A. H. Ruhak, NW NW SW 17-3s-51w, dry, TD 4,663 ft.

Anderson-Prichard Oil Corp. 1 Hamlin, NW NW SE 23-4s-55w, dry, TD 5,279 ft.

Weld County: Charles D. Edmonson 1 State, SE NE SE 16-8n-56w, dry, TD 6,040 ft.

NEBRASKA WILDCAT FAILURES

Chase County: Collins & Wilfong 1 Potter, C S½ NE NE 12-6n-42w, dry, TD 3,260 ft.

Cheyenne County: Chicago Corp. and Republic Natural Gas Corp. 1 Taylor & Ladegard, SE NE NE 20-13n-49w, dry, TD 5,325 ft.

Garden County: Lucerne Oil Co. 1 Peterson, SE SE NW 35-22n-45w, dry, TD 3,531 ft.

UTAH WILDCAT FAILURE

San Juan County: Dan Danvers 1 Harris, NW NW NW 15-40s-16e, dry, TD 700 ft.

NORTHERN NEW MEXICO SUCCESSFUL WILDCAT

San Juan County: Stanolind Oil & Gas Co. 13 USG, SE SW NE 19-29n-16w, 146.9 bbl. of 69.5°-gravity oil and 6 bbl. water from Mississippian, new pay, TD 7,453 ft. Mississippian 6,910 ft., PBTD 7,080 ft.

MONTANA SUCCESSFUL WILDCAT

Big Horn County: George J. Greer, Trustee, 2 Kendrick, NE NW NW 6-1s-35w, est. pump potential 150 bbl. oil per day from Tensleep 4,558 ft., new field, TD 4,588 ft.

MONTANA WILDCAT FAILURES

Big Horn County: Shell Oil Co. 2 Crow, NW SW NW 6-10s-38e, dry, TD 5,045 ft.

Dawson County: Williston Oil & Gas Co. and Delta Drilling Co. 1 Trangmoe, SW NE NW 6-14n-55e, dry, TD 9,484 ft.

Fergus County: B&L Drilling Co. 1 Wildin, NE SE NE 27-13n-23e, dry, TD 2,205 ft.

Hill County: Northern Pump Co. 1 State,

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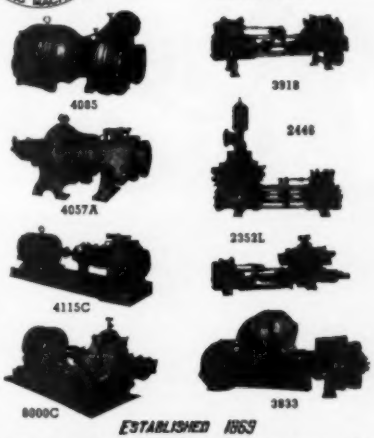

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Stillwater County: James H. Snowden et al 1 Murane, E½ SE SW 19-2s-21e, dry, TD 7,170 ft.

NORTH DAKOTA WILDCAT FAILURE

Stutsman County: General Atlas Corp. 1 Floyd Barthel, C SW NE 15-142n-65w, dry, TD 3,427 ft.

ARIZONA WILDCAT FAILURE

Navajo County: Sinclair Oil & Gas Co. 1 Navajo, 6,750 ft. from E-3,150 ft. from N of Tract 3, Sale 3, unsurveyed lands, dry, TD 7,211 ft.

Oklahoma

New Springer Discovery Made in Garvin County

AN exceptionally good Springer-sand oil discovery appears to have been made by Magnolia Petroleum Co. at its 1 Duncan, located in the NE NE SE 1-3n-4w, southeast of Lindsay, western Garvin County. Top of the Springer was logged at 9,013 ft., and with pay penetrated to 9,048 ft., a drill-stem test, open 100 minutes, got gas within 12 minutes and flowed clean oil in 40 minutes, putting 35 bbl. in the tanks within an hour. Break-down recovery was 5,900 ft. of 39°-gravity oil. Bottom-hole flowing pressure gaged 1,800 psi.

Location is off the west flank of the Golden Trend development on the eastern rim of the Anadarko basin. Springer sand is productive in two other pools along this trend in the county. One, the East Purdy pool, opened last May by Phillips Petroleum Co., is located 2 miles to the southeast. The other, Southeast Purdy, opened last January by Vickers Petroleum Co., is 5½ miles southeast.

Promising gas-distillate showings also have been encountered in what is reported to be Springer sand at G. C. Parker's rank wildcat, 1 Boyd Miller, 3 miles north of Independence, in Custer County, western Oklahoma, in the middle of the Anadarko basin. Spot location is in the C NE SW 22-15n-16w. Pay zone, believed to be Springer, was topped at 11,480 ft., and in a 60-minute drill-stem test with bottom of the hole at 11,515 ft., the well flowed gas in 30 minutes and recovered 1,725 ft. of gas-cut water cushion, and 450 ft. of condensate-cut mud with a small amount of free condensate. Gas flow was estimated at 125,000 cu. ft. per day with flowing pressure at 915 psi. Previously reported, the well also encountered gas-distillate showings in the Hoxbar and Deese horizons.

J. M. Huber Corp. has a new gas discovery, possibly a major extension the sizable Light Ranch gas-distillate field, at its 1 Sid Sharp, C NE NE 13-6n-21eCM, northwestern Beaver County, in the Panhandle. Producing from Morrow sand, opposite which casing is perforated at 5,977-6,002 ft., the well, on a 20-minute test, flowed at the rate of 13,900,000 cu. ft. of gas per day. Location is 2½ miles east of the Light Ranch field, but the field is undefined in that direction. Morrow sand also produces in the field. Location also is only 2½ miles northwest of Carter Oil Co.'s new Greenough field, but production there is from Oswego lime.

J. Tom Grimmett and associates are continuing production tests at their 1 Hennigh, rank wildcat gas-distillate discovery well in the extreme northeast corner of Beaver County, near the Harper County line and just south of Clark County, Kansas. On short tests, the well, still not entirely clean, produced at rates up to 35,000,000 cu. ft. of gas per day with distillate up to 8 bbl. per million. Production is from a series of perforated intervals from 5,792 to 5,922 ft. in the upper part of the Chester lime.

The Texas Co. is completing its 1 Morehead, C SE SW 25-7n-3w, as a new Bromide sand discovery well located a mile southeast of Washington, and 3½ miles southeast of the East Washington pool, in McClain County. With casing perforated at 8,850-60 ft., the well flowed 252 bbl. of oil in 24 hours through ¼-in. choke. Lower Simpson sand zones, drilled to 9,753 ft., failed to show for production.

OKLAHOMA SUCCESSFUL WILDCATS

Grant County: Parker Drilling Co. 1 Mordy, NE NE SW 12-28n-6w, pumped 55 bbl. of oil from Layton 3,992-4,003 ft., TD 5,471 ft.

OKLAHOMA WILDCAT FAILURES

Carter County: Sinclair Oil & Gas Co. 1 Guy Harris-Rickett, SE SW NE 33-4s-1e, dry, TD 8,472 ft.

Garvin County: Sinclair Oil & Gas Co. 1 John McCaughey, C NE SW 19-4n-4w, dry, TD 10,852 ft.

Logan County: Ray P. Diehl 1 Ellis, SE SW SW 14-16n-4w, dry, TD 6,602 ft.

Murray County: Anderson-Prichard 1 Braselton, N½ NE SW SW 22-1s-2e, dry, TD 879 ft.

Anderson-Prichard 1 Freeman heirs, NE SE NW 27-1s-2e, dry, TD 2,929 ft.

Okmulgee County: Four States Oil & Gas Co. 1 Alex Sulphur, SE NE SW 6-12n-13e, dry, TD 2,175 ft.

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Central Area

ILLINOIS

Two extension wells have been completed on the east side of the Allendale Consolidated field in the area 2 miles southwest of Allendale, northeastern Wabash County. One, George & Wrather 1 H. A. Fox, SW NW NW 26-1n-12w, pumped 28 bbl. of oil per day from Tar Springs sand at 1,668-80 ft. The other, Francis L. Beard 1 H. A. Fox, ½ mile to the northwest in the SE SE NW SW, same section, pumped 70 bbl. of oil per day from Biehl sand at 1,400-25 ft. in open hole at 1,375-1,447 ft.

Clark & Clark 1 Rowland Clark, SE SE SE 5-7s-10e, a wildcat in the Concord area, 2 miles north of New Haven, southeastern White County, swabbed at the rate of 300 bbl. of oil per day while testing Aux Vases pay at 2,906-15 ft. The same operators have the pay in their second well, 4 Rowland Clark, a location north of the discovery well, and are preparing to test. They are drilling at their third well, No. 5, a location west of the discovery well. Nos. 2 and 3 are locations.

INDIANA

Sun Oil Co. is confirming the recent discovery of Devonian oil production, now designated as the Riley South pool, by B. L. Fillingames in 34-11n-8w, 8 miles southeast of Terre Haute, Vigo County, Sun's well, 1 McIntosh-Ray, NW NE NW 34, two locations west of the discovery producer, logged the Devonian saturation at 1,682-96 ft. with bottom still in the pay. A 2-hour drill-stem test got gas in 45 minutes and recovered 600 ft. of clean oil, 90 ft. of oil-cut mud, and 60 ft. of mud-cut oil. Casing has been run for completion.

Morris Drilling Co. 1 McRoberts, Military Donation 89-1s-10w, a wildcat located 3 miles northeast of Patoka, in Gibson County, got 900 ft. of gas, 510 ft. of oil, and 60 ft. of oil-cut mud in a 60-minute drill-stem test of saturation found in Benoist sand at 1,654-61 ft., and has run casing for completion. Location is a mile southwest of production in the Union-Bowman area.

E. I. Barker and Paco Petroleum Co. have an indicated Rosiclare oil discovery well, located 1½ miles southeast of Princeton, also in Gibson County, where their 1 Tate, SW SW NW 16-2s-10w, recovered 675 ft. of oil and 205 ft. of heavily oil-cut mud and gas in a 60-minute drill-stem test at 2,090-2,149 ft. Rosiclare saturation was logged at 2,093-2,101 ft. Location is ¾ mile southeast of Princeton East pool, in which nearest production is from Benoist sand.

A two-zone oil discovery, located 2 miles northeast of New Harmony in northwestern Posey County, is indicated by showings encountered by Calvert Drilling, Inc., at its 1 Guenther, SW SE SE 19-4s-13w. Saturation was logged in both the O'Hara and McClosky zones, and casing has been run for completion. A 60-minute drill-stem test of O'Hara pay at 2,873-88 ft. got gas in 4 minutes and recovered 1,800 ft. of oil and 120 ft. of oil and gas-cut mud, plus 960 ft. of water. A similar test of McClosky at 2,927-37 ft. got gas in 21 minutes and recovered 420 ft. of oil and 120 ft. of mud-cut oil without any water. Total depth is 3,019 ft.

WESTERN KENTUCKY

Skiles Oil Corp. has completed its 1 Parker, a wildcat located in 12-L-25, 8 miles northeast of Madisonville, in northeastern Hopkins County, making 96 bbl. of oil per day on the pump from Cypress sand at 2,597-2,604 ft. Total depth is 3,041 ft. This is an old hole, completed last May as dry. Location is 2 miles west of the Pond River pool.

EASTERN KENTUCKY

In Pilot pool of Powell County and Wolfe County, Chas. Ledford et al have added another oiler at their 5 Ledford, White

(Continued on page 174)

Kansas

Oil Showings Indicate New Finney County Pool

DISCOVERY of another new oil pool in Finney County, in the Hugoton embayment east of the Hugoton gas field, is indicated by showings encountered by Cooperative Refinery Association at its 1 Sonderegger, C NE NE 21-22-31. Showings were in the lower part of the Pennsylvanian Cherokee and top of the immediately underlying Mississippian section.

Top of the Mississippian was logged at 4,737 ft. (—1,825 ft.). A 60-minute drill-stem test taking in an interval at 4,707-48 ft. got 1,150 ft. of gas with 200 ft. of free oil and 100 ft. of heavily oil-cut mud. Following the test, hole was carried to 4,968 ft., where casing has been run for production tests.

Location of the indicated discovery is 14 miles northeast of Garden City in the north-central part of the county. It is 4½ miles northwest another pool opened by the same operator last July. Discovery well of that pool, 1-A Stewart, in the NE SW NW 16-

(Continued on page 174)

COLORADO

AN ESTATE — HOME — RANCH — HOTEL RESORT

One of the beautiful views in America for a country home, ranch, hotel resort, about 15 minutes SE of and overlooking Denver, Cherry Creek Dam and Reservoir. View of 300 miles of snow capped ranges. Natural trees, ravines, springs, hills, valleys, wild deer. North extension of Black Forest. Delightful in summer — dreamland in winter — wonderful climate in all seasons. Owner is building on adjoining tract. Purchaser must make high class improvements. 160 to 1280 acres for sale, price reasonable. Further details furnished.

THURMON INVESTMENT & REALTY CO.

218 Broadway, Denver 9, Colo.

Send for Descriptive Bulletin CT-101.

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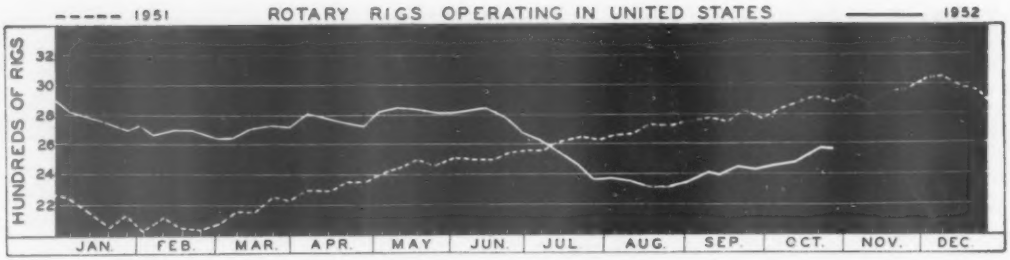
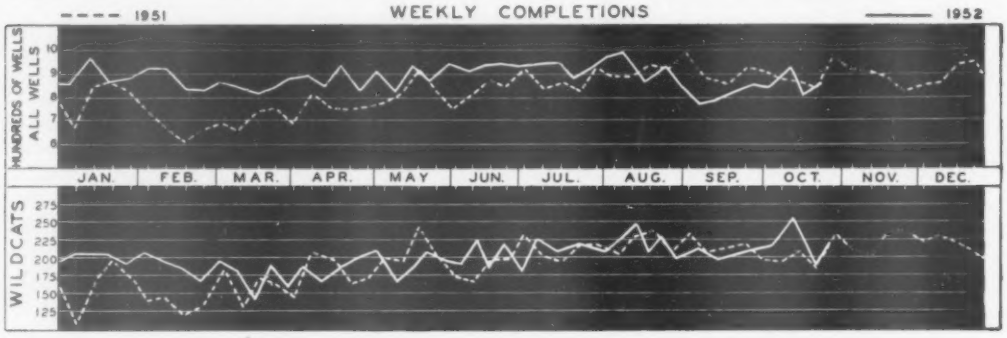




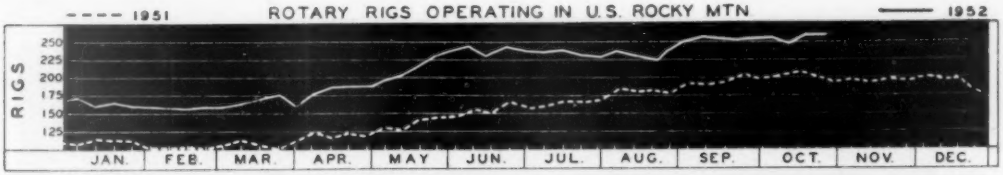
CURRENT STATISTICS

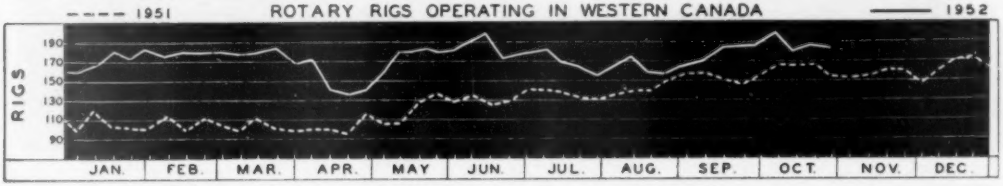
EXPLORATION

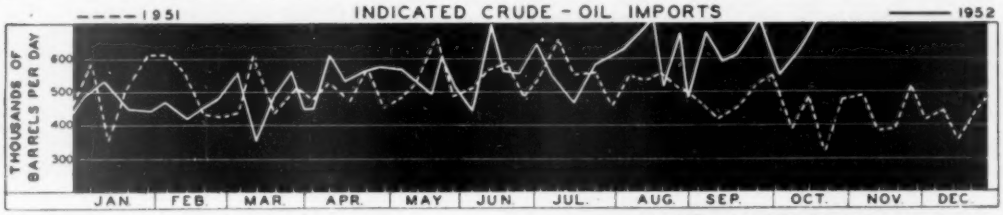
WEEKLY WELL COMPLETIONS . . . WEEK ENDED OCTOBER 25, 1952

	Total of all wells					Oct. 25		Wildcat completions and discoveries					Cumulative total, 1952				
	Comp.	Oil	Gas	Dry	Footage	1952	1951	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	16	8	0	*8	23,500	641	534	0	0	0	0	0	0	0	0	2	2
Pennsylvania	40	21	2	†17	67,757	1,633	1,418	0	0	0	0	0	0	0	0	2	2
West Virginia	10	1	8	1	24,360	508	516	0	0	0	0	0	0	0	4	7	11
Ohio	12	5	1	‡6	21,155	822	800	0	0	0	0	0	2	0	8	16	26
Indiana	20	4	0	16	31,770	1,029	1,152	1	0	0	10	11	30	0	2	300	332
Kentucky	22	9	1	12	34,117	1,061	1,075	0	0	0	6	6	20	0	1	219	240
Illinois	53	16	0	37	129,574	1,675	2,052	1	0	0	17	18	23	0	1	467	491
Michigan	24	4	3	17	59,052	592	633	0	0	1	9	10	22	0	5	203	230
Kansas	75	33	7	‡35	254,322	3,780	3,591	0	0	0	9	9	84	0	13	618	715
Nebraska	6	3	0	3	27,101	258	195	0	0	0	3	3	11	0	2	142	155
Oklahoma	106	56	9	§41	353,983	4,756	4,544	1	0	0	6	7	84	3	11	499	597
Texas	276	146	11	119	1,279,507	14,131	13,696	11	0	3	81	95	660	44	103	3,177	3,984
North Central (Dist. 7-B & 9)	87	47	0	40	299,703	4,458	4,133	7	0	0	28	35	367	2	24	1,299	1,692
West (Dist. 7-C & 8)	75	53	0	22	439,049	4,290	4,176	3	0	0	18	21	144	1	6	599	750
Panhandle (Dist. 10)	7	3	3	1	23,735	543	588	0	0	1	0	1	4	0	8	47	59
Eastern (Dist. 5 & 6)	11	4	1	‡6	66,258	744	1,009	1	0	0	4	5	18	4	4	189	215
Gulf Coast (Dist. 2 & 3)	39	16	3	20	239,282	2,129	1,896	0	0	0	10	10	63	26	27	467	583
Southwest (Dist. 1 & 4)	57	23	4	30	211,480	1,967	1,894	0	0	2	21	23	64	11	34	576	685
Louisiana	70	40	4	26	453,980	1,903	1,794	1	0	1	12	14	38	17	12	261	328
Northern	39	21	1	17	146,506	1,044	984	1	0	0	9	10	16	0	7	134	157
Southern	31	19	3	9	307,474	859	810	0	0	1	3	4	22	17	5	127	171
Arkansas	10	4	0	‡6	41,660	333	350	1	0	0	2	3	7	0	0	73	80
Mississippi	6	3	0	3	43,159	279	297	1	0	0	3	4	16	2	1	128	147
Southeastern States	3	2	0	1	16,491	55	46	0	0	0	1	1	3	0	1	29	33
Montana	13	2	5	6	40,833	276	189	1	0	0	5	6	7	0	1	72	80
Wyoming	19	10	0	9	91,841	560	626	0	0	0	5	5	21	0	4	105	130
Colorado-Utah	15	5	0	10	74,739	439	250	1	0	0	10	11	18	0	8	186	212
New Mexico	14	8	5	1	78,524	851	563	2	0	0	1	3	35	2	1	83	121
California	52	35	1	16	227,157	2,005	1,917	0	0	0	13	13	62	0	6	410	478
North Dakota	4	3	0	1	28,935	87	8	0	0	0	1	1	4	0	0	23	27
Miscellaneous (Md., Ariz.)	2	0	0	2	12,096	60	84	0	0	0	2	2	0	0	21	26	47
Total United States	868	418	57	393	3,415,613	37,734	36,330	21	0	5	196	222	1,147	68	205	7,048	8,468
Total previous week	801	378	67	356	3,088,101			25	1	4	157	187	1,126	68	200	6,852	8,246
Total October 27, 1951	979	524	65	390	3,794,066			26	3	2	199	230	1,271	69	210	6,891	8,441

Service wells included: *8, †15, ‡1, §4.



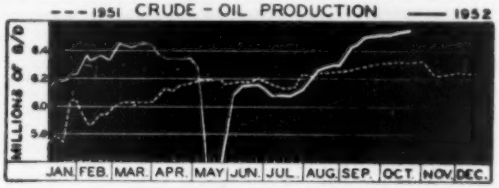


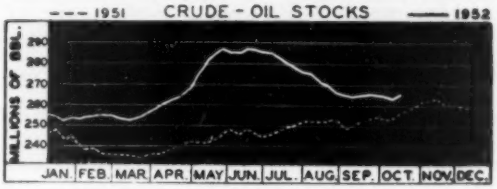


DAILY AVERAGE PRODUCTION FOR WEEK

	October 25, 1952			Oct. 18
	Crude oil	Lease condensate	Total	total
Alabama	3,200		3,200	3,000
Arkansas	75,250	650	75,900	75,400
California	981,400		981,400	982,600
Colorado	87,100		87,100	88,800
Eastern	58,600		58,600	58,600
Florida	1,600		1,600	1,600
Illinois	168,000		168,000	165,500
Indiana	33,700		33,700	33,000
Kansas	354,100		354,100	346,000
Kentucky	31,600		31,600	31,100
Louisiana	643,325	27,500	670,825	671,375
North	109,600	2,000	111,600	112,150
South	533,725	25,500	559,225	559,225
Michigan	36,300		36,300	33,700
Mississippi	91,600	3,600	95,200	95,225
Montana	27,100		27,100	26,800
Nebraska	8,300		8,300	8,300
New Mexico	172,150	400	172,550	172,350
Oklahoma	525,200		525,200	525,400
Texas	2,960,000	42,450	3,002,450	3,002,450
Dist. 1	37,100	200	37,300	37,300
Dist. 2	169,700	4,000	173,700	173,700
Dist. 3	485,100	23,400	508,500	508,500
Dist. 4	272,275	5,000	277,275	277,275
Dist. 5	51,525	250	51,775	51,775
Dist. 6	127,850	3,600	131,450	131,450
East Texas field	249,000		249,000	249,000
Dist. 7-B	110,850	75	110,925	110,925
Dist. 7-C	172,750	5,400	178,150	178,150
Dist. 8	1,015,025	225	1,015,250	1,015,250
Dist. 9	186,500	275	186,775	186,775
Dist. 10	82,325	25	82,350	82,350
Utah	5,500		5,500	5,100
Wyoming	195,000		195,000	194,500
North Dakota	6,100		6,100	5,000
Total U. S.	6,465,125	74,600	6,539,725	6,525,800
Change from previous week, up			13,925	
Canada	205,600		205,600	220,700
Total U. S. production January 1-October 25			1,846,684,725 bbl.	
Same period last year (crude plus cond.)			*1,833,604,600 bbl.	

*Includes 24,294,650 bbl. condensate.



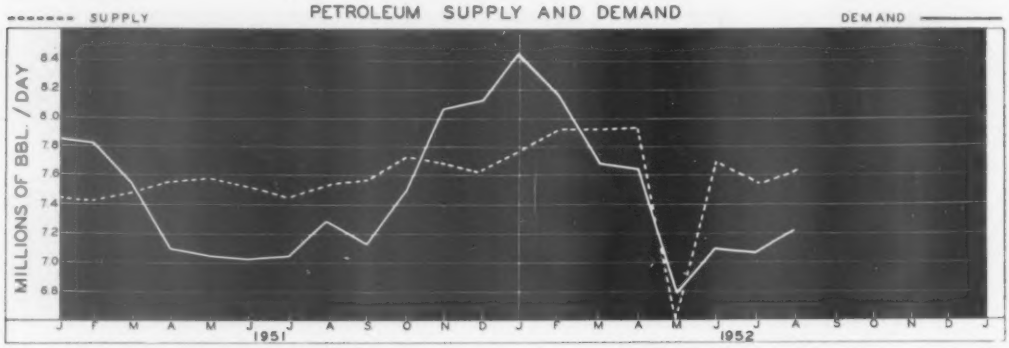


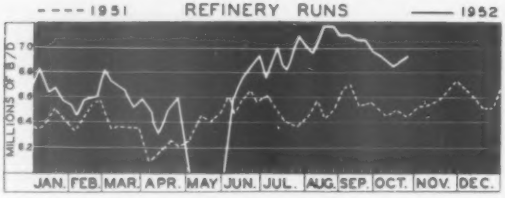
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

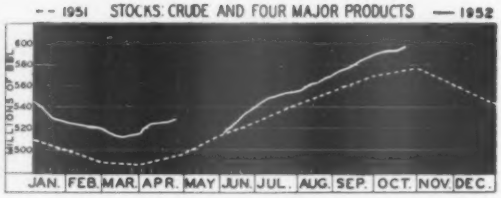
(Thousands of barrels)

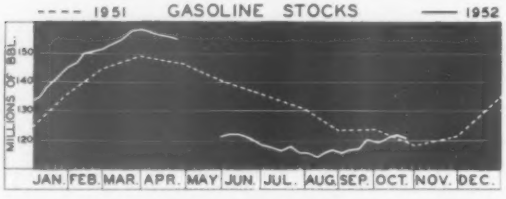
	Oct. 18, '52	Oct. 11, '52	Oct. 20, '51
Pennsylvania Grade	2,308	2,308	2,023
Other Appalachian	2,101	2,172	1,396
Illinois, Indiana, Michigan	11,926	12,086	13,286
Arkansas	2,975	2,866	2,610
Louisiana	15,729	16,024	15,242
North	2,411	2,488	2,860
Gulf	13,318	13,536	12,382
Mississippi	3,150	3,333	3,476
New Mexico	7,366	7,540	7,183
Oklahoma and Kansas	39,156	38,697	39,915
Texas	127,737	125,687	123,515
East Texas proper	12,591	12,367	(†)
West Texas	58,085	56,749	(†)
Texas Gulf	25,765	25,776	(†)
Other Texas	31,296	30,795	(†)
Rocky Mountain	14,430	14,471	13,786
California	31,452	30,916	29,819
Foreign	8,136	6,954	5,957
Total	266,466	263,054	258,208

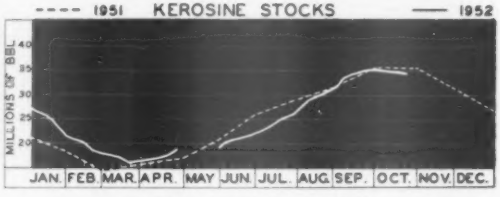
*Bureau of Mines. †Not comparable with current week.

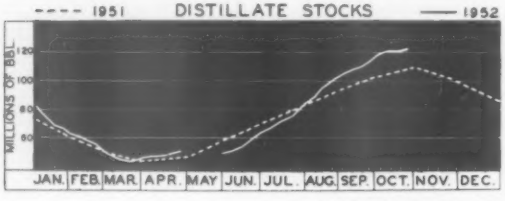


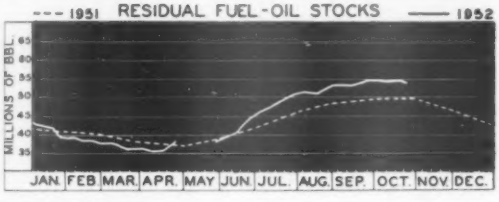










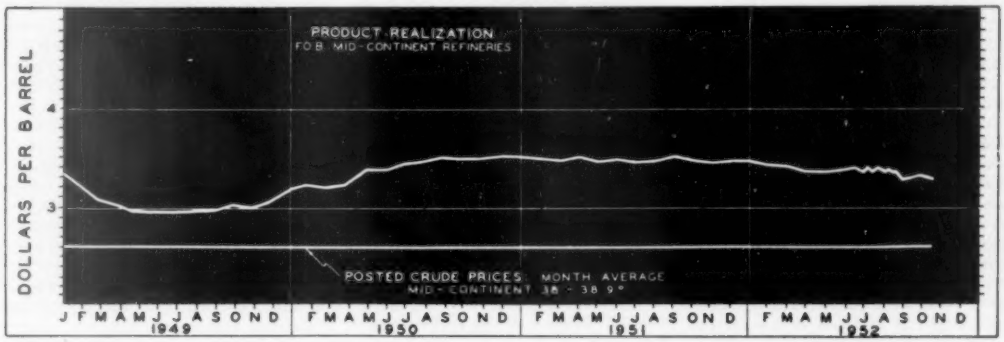


A.P.I. REFINERY REPORT, OCTOBER 25

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, October 1951 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,093	406.0	49.1	252.1	229.9	30,237	14,852	43,992	12,276	975	391.9	39.5	252.8	211.2
Appalachian:														
District 1	92	36.4	5.6	17.3	8.1	3,779	604	1,772	823	103	42.8	5.3	16.4	10.4
District 2	92	44.4	7.7	14.7	15.3	1,747	349	661	390	75	36.8	4.7	9.6	16.6
Ind., Ill., Ky.	1,235	655.3	72.2	225.6	149.7	24,309	7,515	22,849	6,636	1,152	624.3	70.8	190.6	172.2
Okla., Kans., Mo.	527	300.9	13.0	148.0	62.9	11,741	2,158	13,517	1,670	539	286.2	16.9	132.4	61.9
Inland Texas	279	197.7	14.4	45.6	39.3	4,395	450	2,510	1,162	260	183.7	12.7	39.7	41.0
Texas Gulf Coast	1,763	728.9	134.4	417.4	281.7	17,849	4,032	14,552	8,258	1,569	740.6	126.3	336.7	249.1
La. Gulf Coast	521	276.3	46.6	149.7	52.2	6,616	2,998	5,385	1,907	519	243.9	65.4	119.3	57.7
N. La. and Ark.	83	32.9	6.7	19.0	5.7	2,711	613	1,054	297	81	32.4	7.1	16.9	6.3
Rocky Mountain:														
New Mexico	18	10.4	.....	2.9	3.7	106	.....	68	137	17	9.9	0.5	2.5	3.9
Other Rocky Mtn.	211	92.7	6.1	39.3	38.1	3,109	439	2,190	1,060	186	90.9	6.7	35.3	39.7
California	1,024	404.0	0.3	172.8	327.3	14,168	302	13,458	19,485	970	421.8	7.4	143.3	354.0
October 25, 1952	6,938	3,185.9	356.1	1,504.4	1,213.9	120,767	34,312	122,008	54,101	6,446	3,105.2	363.3	1,295.5	1,224.0
October 18, 1952	6,898	3,307.4	371.0	1,454.7	1,202.4	122,002	34,568	120,937	54,450	.....	.....	.....	.....	.....
October 27, 1951	6,461	3,194.4	367.6	1,340.0	1,204.7	121,069	35,906	109,095	50,412	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
4
3
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
J F M A M J J A S O N D
1949
F M A M J J A S O N D
1950
F M A M J J A S O N D
1951
F M A M J J A S O N D
1952

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate and fuel oil. Realization averaged $3.28 for week ended October 18, $3.30 for previous week, and $3.49 for October 1951. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of October 29, 1952. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10⅜-10½	12.125-12.75	10¾-11
Premium gasoline, 86-88 octane	11⅜-11½	13.25-14.0	11¾-12
42-44 w.w. kerosine	8⅝-9	10.4-10.65	9
No. 2 straw fuel oil	7⅝-8	9.4-9.65	8
No. 6 residual	$0.85-1.00	$2.00-2.25	$1.50-1.75

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	6⅞	6¾	6⅝
Grade 18-55	8.25	7.75	8.0

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13-13.5
750 vis., No. 3-4 neutral	16
2,000 No. 5-6 neutral	18-19

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	26-27
200 vis., No. 3 neutral, 0-10 pp.	14-15

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	32.5
180 vis., 0 p.t. neutral	31.5

WAX

Mid-Continent

132-134 A.M.P.	5.5

THE moderate increase in inquiries for heavy fuel oil in many of the markets of the country seems to have been due to the fear of a long coal strike. Most of the added interest in residual was centered on the possibility of a full supply for midwinter rather than on current availability.

During the short period when a general coal strike seemed certain, the outlook for increased consumption of heavy fuel on the East Coast caused some of the distress material to disappear from the open market. The effect was less pronounced in the Mid-Continent area where only a few additional sales were reported.

Most residual markets settled back to early October levels with the passing of the general coal strike threat. Small volumes of heavy fuel in the Mid-Continent were reported moving to resellers at 70 to 75 cents a barrel, but most of the Group 3 material is selling for about 85 cents. Some refiners are quoting 90 cents but no spot sales at that price have been reported for some time.

Distillate inventories are high enough to slow up the firming of markets even with colder weather. In the Mid-Continent, stocks of distillates on pipe lines are large enough to act as a buffer against a rush in demand even in very cold weather. The tank-car market for material from some of the smaller refineries not on a pipe line is restricted to areas not served by a pipe line and to the overflow of demand from all areas when high demands overload the product lines. Because of the high level of inventories both at refineries and on pipe lines the small refiners may not get any overflow this year until midwinter.

Supplies of gasoline are plentiful in all areas. Pipe-line material in District 2 is reported as available at 0.125 cent over the Group 3 low plus transportion, or about 0.25 cent less than last month's price level and 0.375 cent under the summer normal.

CRUDE PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.‡	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.93			
19-19.9	1.98			
20-20.9	2.03	$2.25		$2.12
21-21.9	2.07	2.27		2.14
22-22.9	2.12	2.29		2.16
23-23.9	2.18	2.31		2.18
24-24.9	2.24	2.33	$2.56	2.20
25-25.9	2.30	2.35	2.58	2.22
26-26.9	2.36	2.37	2.60	2.24
27-27.9	2.41	2.39	2.62	2.26
28-28.9	2.46	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.57	2.45	2.68	2.32
31-31.9	2.62	2.47	2.70	2.34
32-32.9	2.68	2.49	2.72	2.36
33-33.9		2.51	2.74	2.38
34-34.9		2.53	2.76	2.40
35-35.9		2.55	2.78	2.42
36-36.9		2.57	2.80	2.44
37-37.9		2.59	2.82	2.46
38-38.9		2.61	2.84	2.48
39-39.9		2.63	2.86	2.50
40 and above		2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico.

Last general price change represented a 50 cent increase, effective December 6, 1947.

‡Standard Oil Co. of California.

FLAT CRUDE PRICES

Representative posted schedules per barrel	
Kettleman Hills, California*	$2.80
Louisiana:	
Beauregard Parish	2.60
Cotton Valley (distillate)	2.85
Cotton Valley (crude)	2.70
Texas:	
East Texas	2.65
Pecos County (Yates)	2.35
Conroe	2.83
Van	2.48
Pennsylvania Grade:	
Bradford	4.25
Southwest Pennsylvania	3.82
West Virginia	3.76
Illinois Basin	2.77

*37°-37.9°.

Natural-Gas Problems

(Continued from page 69)

by Northern. But work has been delayed by its squabbles with the Federal Power Commission.

This trouble with FPC arises from the fact that Northern produces 15 to 20 per cent of its own gas (from the Kansas portion of Hugoton field) and purchases the rest under long-term contracts. Its cost of purchased gas, at whatever the price may be, is considered an operating cost and becomes part of the base for fixing rates at which it sells gas at the delivery end of its lines. But gas produced by it, even from an adjacent well, is treated differently by FPC. It is not allowed to go into the rate base at the prevailing field price, but at a price calculated to yield 6 per cent return on the depreciated original cost of the reserves.

This means, in some cases, that Northern's own gas is valued by FPC at 2.5 or 3.5 cents per M.c.f. while gas from nearby wells is sold—to Northern or some other purchaser—at 8 cents or more. Northern's owned reserves in Hugoton field are valued by FPC at $600,000, whereas the company says it could sell them today for $52,500,000.

Threat of divorcement . . . Other natural-gas pipe lines have this same trouble with FPC, which is why some of them don't produce any of their own gas but purchase their entire supply. One line, Panhandle Eastern Pipe Line Co., sold its reserves to a subsidiary, Hugoton Producing Co., and contracted to buy the gas back at prevailing field prices as produced. The FPC tried to stop this, but the Supreme Court upheld Panhandle's action.

This prompted Northern to put in its 1950 annual report the statement that "if equitable treatment cannot be obtained for the stockholders otherwise, the company may find it necessary to sell the gas in place to independent companies."

This simple statement has caused the company all sorts of trouble and has delayed its construction program by more than a year.

Expansion stymied . . . In February 1951, Northern filed with the FPC an application for a certificate of public convenience and necessity authorizing it to increase its capacity from its then 600 million cubic feet per day to 825 million. It proposed to loop sections of its trunk line, add more compressors, and install extensive gathering facilities, and have the new capacity ready by fall of 1951 to take care of orders on file from its 230 communities.

But FPC didn't act on the application until October. Then it hastily gave Northern a temporary certificate to add 75 million a day to its capacity for emergency service that winter. It was not until June 1952 that the FPC issued a certificate for the rest of the project.

Conditions imposed . . . But this certificate had a lot of conditions attached to it. Most important was a requirement that Northern agree to commit its 1.5 trillion feet of reserves in Hugoton field to the new service and that it amend its tariffs so that this commitment of reserves would become a contract with the local utility distributor in each of its 230 communities.

The commission said that the sentence in Northern's annual report was a threat to "alienate" about 25 per cent of the reserves needed to maintain the system, and might leave consumers without gas supply.

Northern refused to accept the certificate under this condition. It said its reserves were just as much dedicated to the new construction as they had been to earlier expansions, and just as much as the dedication of reserves of any other pipe line ever approved by FPC. It said that the most it would ever do—if it did anything—would be to sell the reserves in place to a producing company under a contract to buy back every foot of the gas as produced.

It said that the restrictions would prohibit it from normal buying, selling, and trading wells and leases, and make its operation so inflexible that it might end up with less gas. For instance, Northern might find a better supply of gas in Texas, or Canada, or Nebraska which it would want to substitute for its Hugoton acreage. It said that the commission's action was illegal, was prevented by the Panhandle decision, and was an attempt to regulate production and gathering of natural gas—something prohibited to FPC by the law.

Northern asked for a rehearing, which was held September 10, and proposed a different sort of condition under which it pledged to commit its Hugoton acreage or an equivalent volume of reserves to the service it proposed to render. But now the second winter is approaching and Northern has not started the construction work it hoped to have in operation a year ago.

Still trying to grow . . . But Northern is still trying to get its expansion program back on schedule. In August it purchased control of Permian Basin Pipeline Co., a new concern which has an application before FPC to build 384 miles of line from West Texas through a corner of New Mexico and back into the Texas Panhandle. From the Spraberry area and other fields it would pick up 300 million feet a day of gas and deliver it to Northern's southernmost compressor station at Skellytown in the Texas Panhandle.

In September Northern asked FPC for a certificate to enlarge its own system to handle this additional gas by the 1954-55 heating season. This construction, plus other expansions pending, would bring Northern's total capacity to 1,100 million cubic feet per day within the next 2 years—if the FPC grants the necessary authority soon enough and under conditions which Northern can accept.

Problem of costs . . . Meanwhile all of Northern's costs and expenses have been going up, and so have the prices of competing fuels. So the company undertook a program to get is rates increased. But here again it ran into all sorts of trouble with the Federal Power Commission.

When costs were going down, due to additional volume without commensurate plant expansion, Northern negotiated rate decreases with the FPC on an informal basis. But when it tried to raise rates the commission insisted on formal procedures.

Northern's first application for a rate increase was filed March 1950. The FPC didn't act until August, when it suspended the tariff and ordered a hearing, which it didn't get around to holding until March 1951. Meanwhile Northern filed another rate increase in October 1950, and ran into the same delay. The two together would increase Northern's income by about $9,500,000 annually, and cost the average householder heating with gas about 90 cents per month.

By winter the commission still had not acted on these two rate increases, so in December 1951 Northern filed a third rate increase for an additional $10,600,000 a year. The commission compelled Northern to reduce this filing by about $7,500,000, pending the outcome of its first two rate cases, and the matter is still in dispute.

Finally, in June 1952, the FPC issued a decision on the rate applications filed in March and October of 1950. This gave Northern about $5,100,000 annually in additional revenue, roughly half of what it asked.

Consternation on rates . . . This rate decision of last June caused consternation throughout the entire gas producing and transmission industry because of the methods used by the commission in whittling down Northern's rate base.

In September Northern filed a petition in the U. S. Court of Appeals for the Eighth Circuit asking review of this rate order and charging that the commission exceeded its authority in eight different ways.

Of the eight allegations of "error" on the part of FPC, three have attracted the most general attention. These are "attribution," "cost of money," and "allocation of costs."

Attribution . . . As a conservation measure, the State of Kansas has a law setting minimum field prices for natural gas. The validity of this law has been upheld by the Supreme Court of the United States. The Kansas Corporation Commission set a price of 8 cents per M.c.f. in Hugoton field, and ordered Northern Natural to "attribute" 8 cents to gas it produced from its own leases.

But FPC would not allow this attribution. It priced Northern's gas at cost of production — about 2.5 cents per M.c.f.—although Northern was paying 8 cents for purchased gas in the same field and was paying royalty at the rate of 8 cents on its own gas.

This action has alarmed gas producers, who see it as another attempt of the FPC to regulate production and gathering and as a threat to their current efforts to raise the general level of field prices. It has strengthened the determination of some pipe-line companies not to produce their own gas. Officials of producing states have denounced it as federal interference with conservation. The Kansas Corporation Commission filed a court appeal a few days before Northern Natural did.

Cost of money . . . The cost-of-money formula used by the FPC reduced Northern's rate of return to 5½ per cent, although the commission always had used 6 or 6½ per cent as standard. The formula is a bit complicated, but its net effect appears to be to give holders of common stock about the same return as bondholders, thus eliminating the "growth factor," or appreciation in the value of the equity. This has alarmed investors, and some security analysts and institutional investors predict that it will dry up the supply of new money for gas-transmission projects. *(The Oil and Gas Journal, October 13, page 168).*

Cost allocation . . . The controversy over allocation of costs for rate-making purposes is also complicated, but arises from the fact that Northern, like all pipe lines, sells some gas to local utilities for public distribution under rates regulated by the FPC, and some gas for direct consumption by industries under rates which are not supposed to be regulated by the FPC. Industrial sales are usually made under interruptible contracts which permit suspension of deliveries on peak-demand days.

In the Northern rate case the FPC allocated costs between various types of services and contracts in such a way as to keep down the rates to household consumers. Northern claims this is an interference with management, an illegal extension of FPC's jurisdiction over things not contemplated by the law, and an attempt to subsidize householders at the expense of industrial users of gas.

Interference with management . . . Some utility men say that if FPC is permitted to tell gas companies how to keep their books and allocate costs, this part of the Northern rate decision will do more ultimate damage to the gas industry than all the other objectionable features of the decision.

The other points of the decision which Northern has appealed to the courts have to do with technicalities of rate-making. Northern's complaint can be summed up as allegations that the commission is interfering with the functions of management, undermining the financial structure of the gas industry, unduly favoring household consumers with unfairly low rates, failing to consider the positions of producers and investors, and being swayed by the arguments of its staff to the extent of ignoring evidence and arguments presented by the transmission companies.

Why own reserves . . . Why, then, when ownership of gas reserves causes it so many headaches, is Northern actively trying to acquire more?

Its officials explain that they have an obligation to supply all the demands of their marketing area. Gas reserves and long-term purchase contracts are hard to acquire these days, and some recent sales have been at very stiff prices—15 cents or more per M.c.f. for pipe-line gas. Oil producers are not exploring for gas in areas where Northern could use it as actively as Northern would like. And there is always hope that the FPC will change its policy so as to make it attractive—instead of a penalty—for a pipe-line company to own part of its gas reserves.

So Northern has set up an extensive exploration department in its Omaha headquarters.

Northern started purchasing proven gas leases in 1936, and soon after the end of the war it began exploration work on a small scale. Now the company has four geologists in Omaha, and other gelogists and land men in branch offices in Amarillo, Tex., Bismarck, N. D., and Calgary, Alta. The staff is being enlarged steadily, and other branch offices are under consideration. The company is considering budgeting about $2,000,000 a year for exploration work.

Basin interests . . . Northern now owns more than 500,000 acres of undeveloped leases in favorable wildcatting territory. During the past 2 years it has acquired 200,000 acres in the Williston basin of North Dakota and Montana, 70,000 acres in the Denver-Julesburg basin of Colorado and western Nebraska, 85,000 acres in the Salina basin of central Kansas and Nebraska, and 150,000 acres in the Anadarko basin of western Oklahoma and Kansas.

At present Northern has three seismograph parties in the field, and plans to drill four to six wildcat wells before the end of this year. Most of the exploratory drilling on its leases probably will be done by farmouts, with Northern having first call on gas.

The Williston basin looks particularly attractive to Northern, since it is relatively close to its marketing area. Oil wells producing from the Madison formation in the basin are producing about 250,000 cu. ft. of gas per day each. There are about 50 wells completed and 25 drilling, and plans have been announced for construction of a natural-gasoline plant in the North Dakota part of the basin, which would gather and process gas for pipe-line transmission. However, it may be 2 or 3 years before the available supply exceeds the local requirements of communities in the producing region.

Canadian ventures . . . Northern is even looking across the Canadian border for gas. Recently it purchased 100,000 shares of stock of Husky Oil Co. of Cody, Wyo., and got first rights to all gas produced by Husky and its Canadian subsidiary, Husky Oil & Refining, Ltd. In southern Saskatchewan, Husky has 3,000,000 acres of exploration leases, including areas where gas has recently been discovered. In the foothills belt of southwestern Alberta, between the Turner Valley and Pincher Creek fields, Northern and Husky are jointly drilling a wildcat well on a block of 78,000 acres controlled by Husky.

Still more recently John Merriam, president of Northern, was elected to the board of directors of Calgary & Edmonton Corp., Ltd., which has mineral rights on more than 1,000,000 acres in Alberta, including large parts of the important Turner Valley and Pincher Creek fields. Calgary & Edmonton, in partnership with other Alberta oil companies, has just started an extensive exploration campaign, and

(Continued on page 181)

Central Area

(Continued from page 167)

and Tidwell Tract 6. Corniferous lime topped at 1,150 ft. and drilled to a total depth of 1,184 ft. made, on initial tests, 30 bbl. of oil daily. In the same area but west of the above well Sherman Hall 9 E. H. Fuller has been completed as a dry hole in the Corniferous lime.

In big Sandy gas field, Kentucky West Virginia Gas Co. has completed a good gas well at their 6076 Miles Smallwood in the Pike County sector. An open flow potential of 1,485,000 cu. ft. of gas daily was had from Mississippian Big lime at a total depth of 2,843 ft.

MICHIGAN

Swab-testing in the Dundee, after 5-in. casing cement plug was drilled out, was in progress at the Lud Segerlund 1 Caner et al, NE NE NE 11-19n-5w, Greenwood Township wildcat, Clare County, most likely looking new Michigan Dundee oil discovery well. This well, which bottomed out for testing in the Dundee at 4,066 ft., after top of Dundee was logged at 4,052 ft., was reported to have swabbed more than 18 bbl. of clean oil first day after hole had been cleaned of cement and filter cake. Swabbing was to be continued for about two more days and then acidized.

A new Newaygo County Stray sand gas discovery well was credited to Sun Oil Co. at its 1 Graham, NW SW NE 17-11n-11w, Easley Township, after both Traverse and Dundee oil objectives were drilled out dry. Hole was bottomed out in the Dundee at 3,099 ft., and well was then plugged back to 911 ft. to test the Stray sand which was topped at 800 ft. Well was rated good for 600,000 cu. ft. of gas a day after this plug-back and rework.

The second follow-up Traverse oil test to Sun Oil Co. Cherry Grove Township discovery, Wexford County, was drilled out dry as was the first well drilled following the completion of the discovery well. Sun, it was announced, would move to the west for the next test. Current failure was at the 1 Wyatt, SW NE SW 27-21n-10w, the diagonal northeast 40-acre offset to the producer. Well was quit at 3,195 ft. First failure was the south 40-acre offset to the discovery well.

ILLINOIS SUCCESSFUL WILDCAT

Wayne County: Collins Brothers 1 Jones, NE NW NW 5-2s-9e, IP 107 bbl., Benoist 3,097-3,109 ft. and Aux Vases 3,222-46 ft., TD 3,249 ft. (extends Goldengate West pool).

ILLINOIS WILDCAT FAILURES

Bond County: J. C. Nickerson 2 Utlaut, SE NW NW 33-4n-3w, dry, TD 1,067 ft.

Pure Oil Co. 1-A Ulmer, SW SE NE 32-5n-3w, dry, TD 2,500 ft.

Clark County: L. Brissenden 1 Geisert, NE NE SE 3-10n-14w, dry, TD 518 ft.

Clinton County: R. K. Hammel 1 Billhartz et al, SW SW NE 6-1n-5w, dry, TD 2,858 ft.

Edwards County: Ashland Oil & Refining Co. and Illinois Mid-Continent Co. 1 Ably, SW SW NE 17-2s-10e, dry, TD 3,463 ft.

Fayette County: Cullum & Lawhead 1 Reece, NE SW SW 18-6n-3e, dry, TD 1,575 ft.

Jasper County: H. F. Gibson 1 Thomas, SW SW SW 21-6n-8e, dry, TD 3,154 ft.

Jefferson County: Milton Smith 1 Sinclair, NW NW NE 5-1s-3e, dry, TD 2,494 ft.

Lawrence County: West Drilling Co. 1 Storckman, NE SW NE 28-2n-13w, dry, 2,429 ft.

Macoupin County: M. Mazzarino 1 Mount Olive, SE NW NE 14-7n-6w, dry, TD 595 ft.

Randolph County: T. G. Glass 1 Ruebke, N½ NW SE 3-6s-5w, dry, TD 2,526 ft.

Chesray Oil Co. 1 Russell-McConashie, NW NW NW 28-5s-5w, dry, TD 2,400 ft.

Richland County: Magnolia Petroleum Co. 1 Lewis, NW NW SW 17-3n-10e, dry, TD 3,202 ft.

Modoff & Anderson 2 Gray, SE NE NE 18-4n-9e, dry, TD 2,750 ft.

St. Clair County: J. W. Jaske 1 Hankamer, NW SE SW 4-1s-9w, dry, TD 1,253 ft.

Washington County: Dale Hopkins 1 Liszewski, NW SE NW 3-3s-2w, dry, TD 1,505 ft.

Wayne County: W. L. Griffith 1 Goff, NE SW SW 25-2n-5e, dry, TD 3,000 ft.

INDIANA SUCCESSFUL WILDCAT

Knox County: Lewis & Clemens 1 Hancock, SE NW NW 21-2n-8w, IP 30 bbl., Rosiclare 1,460-64 ft., TD 1,464 ft.

INDIANA WILDCAT FAILURES

Crawford County: Lambert & Hood 1 Baird, WL SE NE NE 12-3s-1e, dry, TD 525 ft.

Daviess County: Buell Abney 1 Ardord, NW SE NE 18-5n-5w, dry, TD 652 ft.

Knox County: Eidson & Gwaltney 1 Nicholson, NE NE SE 22-5n-7w, dry, TD 923 ft.

Pike County: D. Jobe 1 Julian, NE NW NW 33-1s-8w, dry, TD 1,517 ft.

Posey County: Rush Creek Oil Co. 1 Barrett-Elliot, SE NW NW 13-5s-14w, dry, TD 2,053 ft.

Slagter Producing Co. 1 Doll, NW SE NW 12-4s-13w, dry, TD 2,946 ft.

Sullivan County: F. Runyon 1 Carty, NE SE SW SW 21-8n-8w, dry, TD 2,266 ft.

Vanderburgh County: A. W. Cherry 1 Kemp, NW SW SW 11-8s-11w, dry, TD 2,600 ft.

Vigo County: F. B. Cline 1 Reed, SE SE NE 28-10n-10w, dry, TD 1,405 ft.

Oil & Gas Development Co. 1 Pyramid, SW SW NE 22-12n-8w, dry, TD 1,807 ft.

WESTERN KENTUCKY WILDCAT FAILURES

Breckenridge County: George Hobbs 1 Phillips, WL NW SE SE 10-N-35, dry, TD 546 ft.

Hancock County: J. E. Newton 1 Ray, NW NE SE SE 3-P-34, dry, TD 1,330 ft.

Henderson County: I. B. Browning 2 Poole, N½ SE SW SE 17-O-23, dry, TD 1,801 ft.

Kingwood Oil Co. 1 A. Waller estate, NE SW SE SE 21-Q-26, dry, TD 1,251 ft.

Markay Oil Co. 1 Cooper, W½ SE NE SW 6-P-22, dry, 2,721 ft.

Ohio County: C. L. Faith 1 Wallace heirs, SW SW SE SE 17-N-34, dry, TD 530 ft.

SUCCESSFUL MICHIGAN WILDCAT

Newaygo County: Ensley Township: Sun Oil Co. 1 Graham, NW SW NE 17-11n-11w, Michigan Stray sand 800 ft.; Traverse 2,509 ft.; Dundee 2,927 ft., dry, in Traverse & Dunee, TD 3,099 ft., PBTD 911 ft., perfo-jet 49 shots 877-93 ft., 600,000 cu. ft. gas a day.

MICHIGAN WILDCAT FAILURES

Allegan County, Otsego Township: Rex Oil & Gas Co. 1 Roberts, NE NE SW 4-1n-12w, Traverse 1,439 ft., dry, TD 1,470 ft.

Clare County, Lincoln Township: Swan-King Oil Co. 1 Bierly et al, SE NW SE 4-18n-5w, Michigan Stray and 1,662 ft., dry, TD 1,763 ft.

Huron County, Bloomfield Township: Graham Wilcox 1 McDonald, NW NE NE 20-17n-14e, Traverse 1,416 ft., dry, TD 1,420 ft.

Manistee County, Pleasanton Township: The Carter Oil Co. 1 Crook, SE NW SW 35-24n-15w, dry in Niagaran, TD 4,861 ft.

Montcalm County, Crystal Township: Columbia Oil & Gas Co. 1 Hummel, SE NE SW 31-10n-5w, Dundee 3,127 ft., dry, TD 3,376 ft.

St. Clair County, Clyde Township: Panhandle Eastern Pipeline Co. 1 Wurzel Comm., C NW 15-7n-16e, dry in Niagaran, TD 3,720 ft.

Saginaw County, Jonesfield Township: Cities Service Oil Co. 1 Larson, SE SE SW 4-12n-1e, Dundee 3,361 ft., dry, TD 3,650 ft.

Van Buren County, Arlington Township: Norman L. Stevens 1 Whiteman, SE NW SE 14-2s-15w, Traverse 1,109 ft., dry, TD 1,136 ft.

Van Buren County, Hartford Township: Ambert J. White 1 Bundesman & Harper Comm., NW NE SE 24-3s-16w, Traverse 992 ft., dry, TD 1,020 ft.

Kansas Fields

(Continued from page 167)

23s-30w, produces from the St. Geneviéve (upper Mississippian, topped at 4,714 ft.) with casing perforated at 4,738-46 ft.

National Cooperative Refinery Association has an indicated Lansing discovery well in northern Ellis County, where its 1 Cave, SE SE NW 8-11s-18w, recovered 3,040 ft. of oil and mud-cut oil in a 2-hour drill-stem test at 3,229-92 ft. Top of the Lansing was given as 3,250 ft. The discovery is 2 miles north of the Riverview pool and about the same distance west of the Burnett Northwest pool, nearest production.

A possible new Arbuckle producing area, located a mile south of the Ellis pool, in the east central part of Trego County, has been found by Carl Todd Drilling Co. at its 1 Newcomer, NE NE NE 12-13s-21w. A 60-minute drill-stem at 3,822-37 ft. in the Arbuckle, topped at 3,814 ft., got 105 ft. of gas, 60 ft. of oil-cut mud, 935 ft. heavily cut, and 135 ft. of mud-cut oil.

Westgate-Greenland Oil Co. 1 Weirauch, SW NE NW 29-21s-14w, a wildcat located ¾ mile northwest of the Lincoln pool, Stafford County, recovered 950 ft. of oil in a drill-stem test at 3,780-88 ft. in Simpson sand, topped at 3,718 ft., and has run casing for completion. Total depth is 3,817 ft.

KANSAS WILDCAT FAILURES

Cowley County: R. Cobb 1 Thompson, SE SW SE 17-33e-4e, dry, TD 3,244 ft.

Geary County: F. G. Hall 1 Poole, NE NE SE 7-12s-8e, dry, TD 2,167 ft.

Meade County: Skelly-Gulf 1 Theis "E," SW SW NE 36-33s-26w, dry, TD 5,770 ft.

Pratt County: Pabco 1 Finchem, SW NW NW 31-28s-12w, dry, TD 4,711 ft.

Saline County: W. G. Bruns 1 Shamburg, SE SE NE 33-13s-3w, dry, TD 3,542 ft.

Sheridan County: Empire Drilling Co. 1 Ward, SW SW SW 13-6s-26w, dry, TD 4,248 ft.

Anschutz-Pack Oil Co. 1 Dally, SW SW SE 10-8s-30w, dry, TD 4,730 ft.

Sumner County: L. B. Jackson 1 Yeager, SE SE SE 12-33s-2e, dry, TD 3,304 ft.

Wabaunsee County: Valley Steel Products 1 Eldridge, SE SE NW 32-14s-10e, dry, TD 3,396 ft.

EQUIPMENT MEN . . . in the News

Price Official to Lead Panel at Safety Meeting

B. C. PIERCE

Bennie G. Pierce, safety director for H. C. Price Co., led a discussion on "Safety in Pipe-Line Construction" during the fortieth annual congress and exposition of the National Safety Council in Chicago.

The meeting was conducted by Pierce and marked the first time that pipe-line safety has been included on the agenda at the Safety Council's national meeting.

Participating in the panel discussion with Pierce were Richard A. Gump, executive secretary, Pipe Line Contractors Association, Dallas; S. H. Downey, safety director, Southern Natural Gas Co., Birmingham, Ala.; H. C. Markel, safety director, Phillips Petroleum Co., Bartlesville, Okla.; and Ray M. Garrigus, safety engineer, Tennessee Gas Transmission Co., Houston.

Kraloy Plastic Pipe Adds Jackson to Sales Staff

Kraloy Plastic Pipe Co., Inc., formerly known as The Golden Bear Manufacturing Co., Inc., has announced the appointment of R. L. (Bob) Jackson to its sales staff.

Jackson has a background of 16 years' practical experience in drilling, production, and oil-field sales and service. He spent many years as a special representative for Baash-Ross Tool Co., and is widely known among California oil men.

Johnson Is Named Manager Equipment Division

K. E. JOHNSON

Karl E. Johnson, who for the past 6½ years has represented J. F. Pritchard & Co. as Chicago district sales manager, has been named to succeed Raymond C. Kelly as manager of Pritchard's equipment division in Kansas City. The change became effective November 1. Succeeding Johnson in Chicago will be E. Allen Bailey.

Kelly resigned to accept the position of executive manager of the Cooling Tower Institute, an association of major manufacturers of industrial water-cooling equipment.

BS&B Names Four Asst. Regional Managers

PAUL BARTLEY

L. E. JONES

ED REIF

ED POOL

Floyd C. Myers, manager of branch operations of Black, Sivalls & Bryson, Inc., Oklahoma City, has announced the appointment of four assistant regional managers for the Gulf Coast and West Texas region.

Paul Bartley, formerly Lafayette branch manager, has been named assistant regional manager for the Gulf Coast region. Ralph A. Stevens, Houston, is manager of the Gulf Coast region. Bartley will have supervision of the Lafayette, Lake Charles, Brookhaven, Shreveport, and Kilgore branches.

L. E. (Buck) Jones, formerly Alice, Tex., branch manager, has been named assistant regional manager covering the Houston and Alice branches in the Gulf Coast region.

Appointed assistant regional managers for the West Texas region are Ed Pool, formerly Odessa branch manager, and Ed Reif, formerly Casper, Wyo., branch manager. H. C. Fessler, Midland, Tex., is manager of the West Texas region. Pool will supervise the Odessa, Hobbs, and Farmington branches. Reif will be in charge of branch operations in Lubbock, Snyder, and Graham, Tex.

Ideco Signs Export Agreement With Hall-Scott

Geo. W. Walton, vice president of Ideco Division, Dresser Equipment Co., recently announced that an exclusive agreement has been signed with Hall-Scott Motor Division, ACF-Brill Motors Co. for the world sales rights outside of continental United States for Hall-Scott industrial engines.

Hall-Scott, in recognizing the increasing demand for its line of industrial engines, are now in position to offer these engines for wider distribution. At present, the most popular industrial models are Hall-Scott's 400-0 which develops 274 hp. at 1,800 r.p.m., and the V-12 Model 2269-0 which develops 545 hp. at 1,800 r.p.m. Hall-Scott engines have gas-butane carburetors which enable operators to use available fuel and reduce fuel costs. Another outstanding feature is their ready adaptability for use with torque converters, which Ideco has employed extensively in oil-field machinery for a number of years.

Hughes Tool Names Kelly Regional Representative

H. M. KELLY

H. M. Kelly has been appointed special regional representative of Hughes Tool Co. in Tulsa. Prior to his move to Tulsa he was special sales representative in Hughes' general sales department in Houston. Kelly replaces J. S. George who resigned to become vice president and general manager of B & R Division of Trans Era Oils, Ltd., in Wichita.

Kelly began his association with Hughes in Midland, Tex., in 1937 as a field salesman, later transferring to Illinois where he became branch manager. His oil industry experience dates from his employment by Big Lake Oil Co. while he was attending Texas Christian University.

McKee & Co. Organizes Canadian Subsidiary

H. E. Widdell, president of Arthur G. McKee & Co., engineers and con-

tractors, Cleveland, has announced the opening of offices of a Canadian subsidiary, Arthur G. McKee & Co. of Canada, at Toronto, Ont., and the appointment of Ralph A. Westervelt as vice president to direct the operations of this office. Westervelt is a native Canadian with 23 years of specialized experience in the field of engineering.

Like the parent company, the Canadian subsidiary will specialize in the design, engineering, and construction of petroleum processing facilities, blast furnaces, open-hearth shops, rolling mills, treating plants, and related facilities. Directors of the new company are H. E. Widdell, H. R. Moorhouse, Myran J. Livingston and Merrill Cox.

In discussing the Canadian company's plans, Widdell, who is also president of the Canadian subsidiary, stated that all services and facilities of the American organization will be available in Canada through the subsidiary.

Detrick Is Transferred to Milwaukee for A. O. Smith

H. F. Detrick, vice president of A. O. Smith Corp., of Milwaukee, has assumed additional responsibilities in the corporation's management and has transferred his operating headquarters from Los Angeles to Milwaukee. In his new assignment Detrick has direct jurisdiction over A. O. Smith's capital goods manufacturing and marketing business. Until October 1 he had been vice president and general manager of the Pacific Coast division, which fabricates welded steel products, petroleum meters, gasoline pumps, electric motors, and other allied products in the petroleum field.

Products which now lay in Detrick's area of management include A. O. Smith line pipe, oil-well casing, refinery equipment, heat exchangers, glass-lined tanks, petroleum meters, and gasoline-dispensing pumps.

Detrick came to A. O. Smith in 1931. Subsequently he carried out numerous engineering, production, and administrative assignments. In 1938 he was made president of Smith Meter Co., a wholly owned subsidiary in Los Angeles which later was absorbed into the parent company.

In 1946 Detrick took over the management of A. O. Smith's newly built water heater plant at Kankakee, Ill. He returned to Los Angeles in 1949 as manager of the company's West Coast manufacturing activities. Last year he was made general manager of all A. O. Smith interests in the West.

Rotary Engineering Reorganized Under Prather, Bliss

Olin R. Prather and Jack E. Bliss have announced a partial reorganization of Rotary Engineering Co. of Midland, Tex.

A combination of persons who are executives of Rotary Engineering has acquired the interest in the partnership formerly held by Richard E. Gile. This group is composed of William C. Hammit, Jr., Hugh B. Gilmour, Arthur J. Joseph, John W. Rahlfs, R. W. Mangum, Dwight F. Fleming, and Mary W. Cesar. All of these persons previously held a minor interest in the partnership.

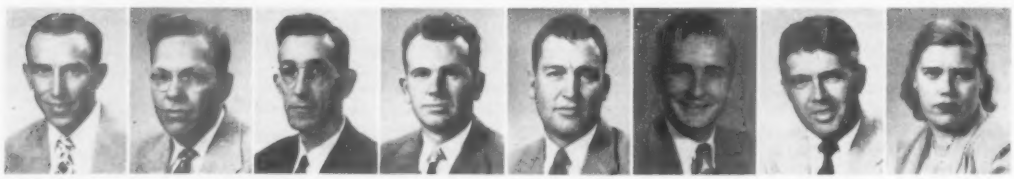
The company is now organized with Olin R. Prather and Jack E. Bliss as cogeneral managers. Arthur J. Joseph is manager of manufacturing and radio; William C. Hammit, Jr., is manager of field operations; Hugh B. Gilmour is manager of office and accounting; John W. Rahlfs is sales manager; Dwight F. Fleming is purchasing agent, and Victor Reinholz is personnel manager.

Assistants to the managers are Robert F. Christy, supervisor of electrical department; E. L. Shepherd, supervisor of radio department; R. W. Mangum, assistant manager of field operations; James A. Brown, Jr., and Olan T. Moore, field supervisors; Richard B. Berry, supervisor of Rocky Mountain division; John G. Holland, assistant sales manager; Glenn E. Chritton, assistant purchasing agent.

Rotary Engineering was organized in 1944 by Olin R. Prather, Jack E. Bliss, and J. R. Mayeaux in Midland. This company offers to the oil industry service of on-location hydrocrabon analyses of cuttings. Rotary Engineering also renders the service of plotting percentage lithology in correlation with hydrocarbon logging, and uses a standard field check for methane detection and for keeping the gas detectors one hundred per cent sensitive. Rotary was first to provide an exclusive two-way radio system between well site and office. This company pioneered the hydrocarbon well-logging service in both the Rocky Mountain area and in Canada. Rotary now offers complete radio service to any user of Motorola two-way radio equipment in the Permian basin.

O. R. PRATHER J. E. BLISS

JOSEPH HAMMIT GILMOUR RAHLFS



FLEMING REINHOLZ CHRISTY SHEPHERD MANGUM BERRY HOLLAND CESAR

Petersen Is Appointed General Sales Manager

E. W. PETERSEN

H. E. Barth, vice president of American Blower Corp., recently announced the appointment of E. W. Petersen as general sales manager. Petersen joined the company in 1923. He became merchandise manager for the packaged products of the corporation's heating and ventilating divisions in 1932, and was elevated to assistant general sales manager in 1951. His new duties will cover all divisions of the corporation.

American Blower is one of America's largest manufacturers of heating, cooling, ventilating, air-conditioning, and air-handling equipment as well as industrial Gyrol fluid drives.

Kaiser Steel to Supply Pipe for West Coast System

Kaiser Steel Corp. has announced it has negotiated a firm contract with Ebasco Services, Inc., aa agent for West Coast Pipeline Co. to supply approximately 88,000 tons of 24 and 26-in. steel pipe for a crude-oil line from Wink, Tex., to the Los Angeles area.

B. E. Hull, chairman of the board of West Coast Pipeline, and L. M. Glasco, president, in announcing recently their intention to construct the 1,000-mile line, said that the original capacity of the line will be 200,000 bbl. of crude oil a day, to be increased to 300,000 bbl. later by the erection of additional pumping stations along the line.

Kaiser Steel will begin delivery of the order, which represents 45 per cent of the total tonnage of pipe required for the line, in the first quarter of 1953. The entire order is to be filled by the end of the third quarter.

Maher Elected Director Of English Oil-Field Firm

John Maher, president of Oil Center Tool Co., of Houston, has been elected a director of the English manufacturing firm of LeGrand, Sutcliff & Gell, according to an announcement from London by D. B. Mirk, board chairman.

LeGrand, Sutcliff & Gell, one of the largest manufacturers of oil-field equipment in the United Kingdom, was established in 1872. The firm operates one plant at Southall, Middlesex, and its large plant at Rochester, Kent.

O-C-T entered into a license agreement in October 1948 for the English firm to manufacture the O-C-T products under a royalty arrangement in the sterling area. "Surveys indicate that there will be a growing market for oil-field equipment throughout the sterling-area countries," Chairman Mirk said in the London announcement. "Because of this increasing demand, LeGrand, Sutcliff & Gell is initiating a program of considerable expansion of present facilities."

Maher becomes the seventh member of the board. Other board members are Mirk, L. P. LeGrand, H. M. Gell, the Right Honorable Lord Strathcona and Mount Royal, C. V. Sims, and the Honorable C. T. Askwith, all of England.

National Supply Mobile Shop Covers Gulf Coast Area

Roy Coulter and his shop on wheels have become familiar sights in the Gulf Coast oil country. Coulter, a field engineer for The National Supply Co., designed a blue and white trailer, in which he carries his equipment directly to the rigs. His specialty is replacing the tool joints on Spang shrink thread drill pipe, a job involving heating the joint while cooling the pipe in order to remove the old joint, then heating a new joint while again cooling the pipe, in order to shrink the joint on the pipe. Originally the joints are shrunk on the pipe at the mill, where special furnaces are available. Heating causes the joint to expand, so that it can be screwed farther on the cold pipe than would be possible otherwise. Then, when the joint cools, it shrinks on good and tight, making it almost impossible to loosen. But because some joints must be replaced in the field, National designed a portable furnace which heats a joint while water is sprayed on the pipe to cool it. Coulter carries four of these furnaces in his trailer, but rarely finds it necessary to use more than two or three for the largest removal or replacement jobs.

West Texas Electric Occupies Dallas Building

Shipping room in the new headquarters of West Texas Electric Log Service Co., Dallas, where duplicate copies of all types of electrical well logs are assembled according to areas. A new fireproof vault now houses over 60,000 logs from wells in North Texas, West Central Texas, West Texas, Texas Panhandle, New Mexico, including the San Juan basin, and a portion of Western Kansas.

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1 Oilwell Steam Pump, 16¼ x 7¾ x 20". 1 Gardner-Denver Steam Pump, 18 x 8 x 20". Both pumps are in excellent condition, may be seen at Makin Drilling Company Yard, Hobbs, New Mexico. MAKIN DRILLING COMPANY, Box 1628, Hobbs, New Mexico.

"GIGANTIC WAR SURPLUS EQUIPMENT SALE." Savings to 70%. Engines, A-C generators, welders, winches, small air compressors, water pumps, electric and gas chain saws, binoculars, many other items. Write for wholesale industrial catalog. BURDEN SALES COMPANY, 931-G "O" St., Lincoln, Nebr.

PIPE FOR SALE
4,000' of 8⅝" ☒ 28# Lapweld Casing—good used material, 11,000' of 4½" 10.79# P.E. Lapweld line pipe—ready to run. All material below ceiling prices. Contact Edco Pipe & Supply Co., Box 151, Tulsa. Phone 4-5970.

FOR SALE: 2,000 8⅝" O.D. 8 V Thread used recessed collars cleaned priced $1.50 each; 1500 12¾" O.D. Used 8 V thread recessed cleaned priced $5.00 each, both in excellent condition, will forward samples if desired. A. A. Gilbert Pipe & Supply Co., Shreveport, La.

3500' OF 3½" BOTTLENECK Drill Pipe. 3600' of 3½" Internal Flush External Upset Drill Pipe. All above pipe Sonoscoped 70% ☒2 30% ☒3. Also 4600' of 4" OD 14# R2 Smls. Drill Pipe w/ 5¼" OD Tool Joints. Milford Giffin, Tel. 477, Hoisington, Kansas.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 30-25-50 KW Generating Units.

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WELL drilling equipment, new or used. Spudders, rotaries, core & shot hole drills, tools, pipe, bits, blocks, pump jacks, valves. Everything for well drilling and service. Fishing tools rented. Pressey & Son, Pueblo, Colo.

DERRICK for sale. We have two guyed type derricks for lifting loads. Main derrick is 80 feet, swings 360 degrees on New Departure Thrust bearings. It also has 34 foot boom, longer boom can also be used. The derrick can also be used as a basket boom. Ideal for loading at a refinery. John A. Costelow Co., 125 Kansas Ave., Topeka, Kans.

I-90 H.P. 2 Cycle Superior direct connected compressor with high and low cylinders with intercooler ready to run. Box 546, Telephone 1060. Bartlesville, Okla.

FOR SALE: Wilson Super Drawworks, 3-speed chain transmission, powered by two JL 1335 Buda Engines with V-belt compound, pump drive from rear. Drawworks and engines in excellent mechanical condition—recently overhauled. Maximum 4,000-foot drilling with 4½" drill pipe. For further information, contact Industrial Supply Company, Wichita Falls, Texas. Phone 2-3155 or LD 13.

FOR SALE: Garnett, Kansas, One 50 hp. 13¼ x 16 Type C, Superior 2 cycle oil engine with plain bearings. Serial No. 20475. New 1937. $750. Joe A. Huitt, Deep Rock Oil Corporation, Tulsa.

FOR SALE

Good Used 48-L and 36-L Bucyrus-Erie Drill with or without Tools.

Beacon Supply Co.

Box 398, Pampa, Texas **Phone 3377**

USED EQUIPMENT

1—Bethlehem Pumping Unit
35 HP—19000# Polish rod load
W/ ZC 503 F&M Gas Engine

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1—W/ 739 F&M Gas Engine
1—W/ 503 F&M Gas Engine

1—Tank Battery, 4—250 bbl. tanks
10'x20' Nt'l Treating System
2½'x10' Nat'l Separator

1—Tank Battery, 2—210 Bbl. tanks
2½'x10' Nat'l Separator

CASING—TUBING—LINE PIPE

BROWN PIPE AND MACHINERY COMPANY

1311 W. T. Waggoner Bldg.
Phone ED 9628, Ft. Worth, Texas

EQUIPMENT FOR SALE

FOR SALE: One 36-L Bucyrus-Erie drilling machine, complete with tools. Also 1,943 ft., new 7 inch, 17 lb., H-40, range 2, seamless casing and 2,409 ft. of new 2⅜ inch 4.60 lb., range 2, J-55, seamless regular tubing. Box E-812, The Oil and Gas Journal Tulsa, Oklahoma.

ONE Emsco-500 equipped with 1-year old 2505 Buda Diesel Engines, Lee C. Moore triple jackknife mast with substructure, Shaffer blowout preventer, steel mud tanks, Kelco power slips, 8,000 ft. 4½-in. drill pipe with Reed Shrink Grip tool joints. Rig is complete, in good condition, ready to run. Box G-125, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Walker-Neer 32-Special new in March 52, complete with all top-to-bottom tools, new lines and 1952 G.M.C. truck. W. H. Bass, phone 1376, Mt. Carmel, Illinois

FOR SALE: R. L. Cardwell with HXE Hercules Engine, 1st class condition, $6,500.00. Fred Cooper E 563 Winch Tractor, Single Drum mounted on six 75-inch Tires, 50 ft. mast, fine condition service 5,500 feet of 2½ inch upset tubing. Box 1215, Tulsa, Phone 5-8850.

COMPLETE Cardwell rotary rig; 6 x 16 pump; 87' Lee C. Moore mast; 3,000' 4½" drill pipe. Price $30,000. Ready to drill. Box G-100, The Oil and Gas Journal, Tulsa Oklahoma.

LARGE National Pumping Unit TH 801 H-40 complete with Cooper Bessemer 40 H.P. Vertical Gas engine, cooler, starter, engine house. Ready to go. Also back crank with extra Jack if desired. Excellent condition. Must be moved now from abandoned wells. Write or phone 6-4847, S. M. Goldschmidt, Box 1052, Wichita 1, Kansas.

FOR SALE: 7500' rotary rig w/ 7250'—4½" B.N. drill pipe, in good condition. Triple Lee C. Moore derrick & substructure. Rig is complete, & in good condition. Ready to drill. A real bargain. If interested write for inventory. P. O. Box 973, Duncan, Oklahoma.

1—I-R XOB 10" Compressor, 2—11" X 16" and 2—8½" X 16" Superior Compressor Cylinders. 5—16" X 20" Worthington Compressor Cylinders. Alfred B. Kern, 223 Wright Bldg., Tulsa, Oklahoma.

FOR SALE: Regan Crown Blocks, Type EM, 5, 6 and 7 sheave 1⅛" and 1¼" groove, 300 and 500 ton capacity. 3—18 X 8 X 20 Gardner-Denver Mud Pumps. 5005 Holmes Road, Houston, Texas. Phone OL-3636.

FOR SALE OR TRADE
A complete Waukesha laboratory aviation supercharge test engine, ASTM designation D909-47T (3C), with adequate spare parts. Excellent condition. Substantial price saving. Quick shipment. Would consider trade for Cetane equipment. R. H. Armstrong, Republic Oil Refining Company, Texas City, Texas.

LATE Type Portable Power Unit. 300 H. P. LeRoi Gas Engine, 8 Cy., 6¾ x 7—Model RXIV. Complete with Electric Starter and Cooling System, DC to 160 KW, 0-600 Volt Generator with Auxiliary 36KW, 230 Volt Generator. We will sell engine separately, if desired. Brazos Engineering Company, 224 Raines Street, Houston, Texas. Phone: FAirfax 8367.

EQUIPMENT FOR SALE

OIL Field Casing, New 5½" and 7" German casing from Houston storage. Immediate delivery. P.O. Box 929, Houston, Texas.

OIL WELL CASING, TUBING, DRILL PIPE AND LINE PIPE. Brand New, Mill Reconditioned and A-1 Used Oil Country Tubular Goods available in any quantities required by end-users and not for resale. GAS CORPORATION, 333 N. Michigan Ave., Chicago 1, Ill.

ALL NECESSARY EQUIPMENT except casing and tubing for completing 5,000 ft. well, including tanks, National Pumping unit, heads, 700 ft. of line pipe, 4,900 ft. of rods and fittings. Located 1¼ miles south and ½ mile west of cotton gin on south side of Prague, Oklahoma. Used only six days. Miners Oil Company, 1208 Philtower, Tulsa, Oklahoma.

EQUIPMENT WANTED

WANTED: Three engine compound for Wilson Titan drawworks. Makin Drilling Company, Box 1628, Phone 3-3141, Hobbs, New Mexico.

WILL BUY, Used, Late model Bucyrus 22-W (with 40' mast). R. F. Hare, 2018 W. T. Waggoner Bldg., Ft. Worth, Texas.

WANTED: Complete light rotary equipment. Prefer Unit 34 or 15 draw works or equivalent, with L. C. Moore derrick. Immediate reply appreciated; cash. K. C. Morton, Choteau, Mont.

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

WANT 7¼ x 12 used Emsco, Gardner-Denver, Oil Well or Lucy mud pump—late models only that are in good shape. R. F. Hare, 2018 W. T. Waggoner Bldg., Ft. Worth, Texas.

WANTED: Oil Well Casing, Tubing, Drill Pipe and Line Pipe, new, reconditioned and A-1 Used. Give complete description, price and location. GAS CORPORATION, 333 N. Michigan Ave., Chicago, Ill.

WANTED TO BUY: Used drilling rig, ready to go. Drill 7,000-ft. hole. Include inventory and location of rig with reply. Box 822, Watertown, South Dakota.

WANTED: Laboratory Equipment, ductility apparatus. Send full particulars to Wisconsin Oil Refining Co., Sheboygan, Wisconsin.

HELP WANTED

WANTED: Chief Engineer for independent MidContinent refinery to take charge of the Maintenance and Inspection Department. Applicant should have experience in inspection work, choice of materials, and refinery maintenance. Box G-131, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Experienced contact man to represent well established oil field service company in West Texas. Prefer background of petroleum engineering or geology. Excellent opportunity. Please write brief letter giving qualifications. (Our employees know of this ad). Box G-141, The Oil and Gas Journal, Tulsa, Oklahoma.

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Major Company has opening in Venezuela for Chemical Engineer or Chemist with experience in operation of Podbielniak Column.

Prefer also experience in operation P.V.T. equipment but not essential requirement. $7100 annual earnings plus maintenance.

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HELP WANTED

MANUFACTURERS representative for established line of oil field specialties in North Texas, Panhandle and West Texas-New Mexico area. Advise experience, lines now being handled and territory covered. Box 2632, Tulsa, Oklahoma.

ASSISTANT Controller — Integrated oil Company in Mid-Continent area is seeking an experienced Assistant Controller. Position requires top-level man with experience in oil, systems and costs. Please submit resume which must give complete data on experience, salary requirements, and personal history, including education, background and associations. Box E-965, The Oil and Gas Journal, Tulsa, Oklahoma.

WELL integrated oil company, operating for the most part in the Mid-Continent and Rocky Mountain areas, is interested in man with executive background and ability to assume position of Vice President in charge of Exploration, Production, and Land Departments. Position open due to retirement of present head involving reorganization. Marvelous opportunity for right man with sufficient qualifications. No other need apply. Salary no object. Box G-147, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED
EXPERIENCED PETROLEUM ENGINEER

Specializing in study of OIL AND GAS RESERVES. Large independent oil company located in Tulsa, Oklahoma. In writing give full particulars as to personal history, academic qualifications, practical experience, references, and salary expected. All communications confidential.

Box G-157
THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

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Write giving age, marital status, education and detailed experience.

Box 308-M, Radio City Station, New York 19, N. Y.

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WELL integrated oil company, operating in the Mid-Continent and Rocky Mountain areas, is interested in a capable and experienced geologist with sufficient geologic background and experience in exploration to assume the position of Manager of Exploration and Geological Departments. Salary open. All replies will be held in strict confidence. Box G-146, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: SEISMIC SUPERVISOR. Must have Party Chief experience, age 30 to 38, degree Geology or Geophysics. Replies will be kept strictly confidential. Call or write giving complete experience. A. E. "Sandy" McKay, Continental Geophysical Co., 602 Continental Life Building, office phone Fannin 9231, Residence phone Sunset 6053, Fort Worth, Texas.

CHIEF PROCESS ENGINEER
Progressive, expanding refinery in Houston area desires Chemical Engineer experienced in Petroleum refining to assume duties as Chief process engineer, must be a leader and assume full responsibilities of position. Salary commensurate with experience. Address replies giving experience, salary desired, etc., to Box G-159, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL Industry Employment Service, 406 Tuloma Bldg., Tulsa, Okla. 4-5974. Tom Robinson, owner. For Technical and Trained Personnel, including LPG.

SEISMIC PERSONNEL needed for United States and Canada by well known and expanding contract geophysical company. Address Box E-863, The Oil and Gas Journal, Tulsa, Oklahoma.

INSTRUMENT man with refinery experience to install and maintain instruments, topping, cycloversion, thermal cracking. Box G-154, The Oil and Gas Journal, Tulsa, Oklahoma.

ASPHALT PLANT CHEMIST. Young man with Ch. E. degree desired. Minimum of three years of refinery experience essential. Must be capable of assuming responsibility and supervising all laboratory testing for 5,000 B.P.D. refinery located in central Southern state. Salary commensurate with training, experience and ability. Excellent opportunity for right man. Forward personal history and experience data to Box G-156, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

REFINERY Superintendent. Age 43, with 22 years experience in operations and construction, three years foreign service, desires new connection with opportunity. Box G-139, The Oil and Gas Journal, Tulsa, Oklahoma.

AIRLINE Transport Pilot, 45, Radio and Electronics Engineer, with 20 years executive experience. Excellent references. Contact R. Z. Glass, 4701 Linden, Bellaire, Texas.

LAND & EXPLORATION MANAGER: 7 years, Mid-Continent, Rocky Mountains, Williston Basin, Western Canada. Presently located — Alberta, Canada. Contract only. Available — January 1. Box 4333, Station "A," Dallas, Texas.

CONSULTING ENGINEER. Available for fee or retainer representation in Rocky Mountains, Permian Basin, and Kansas. Evaluations and Supervision of Royalty or Operating Interests. Geological Reports and Deal Negotiations. References. Box E-962, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL AND GAS Executive, 20 years experience, desires locate Denver, Colorado, area. Adequately qualified all phases petroleum except field work. Box G-161, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM Engineer, Production Superintendent. 6 years experience Gulf Coast area, drilling and production. Desires position with active organization. Box G-148, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 1628. Ph. No. 3-3141, Hobbs, New Mexico.

SITUATIONS WANTED

CHEMICAL Engineer, married, age 41, with heavy experience in project engineering and operation desires position of major responsibility. Box G-153, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION SUPERINTENDENT - PETROLEUM ENGINEER. Oklahoma University. 11 years responsible operational and administrative experience. 5 years sales and management technical services and tools. 4 years assistant general superintendent drilling and producing. 2 years general production manager Kansas and Rocky Mountains. Experienced leases, deal negotiations, geological and engineering evaluations, drilling and producing operations, sales and management. Will carry load and earn way with established, active organization operating Mid-Continent or Rocky Mountains. Age 38. Details without obligation. Box G-115, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING and Production Superintendent, 23 years varied experience. Excellent references. Box G-160, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY Executive. 18 years experience Process Engineering, Refinery Operation, Producing, Pipelines, and Administration with Major Oil Company in Domestic and Foreign Service. M.S. degree in Engineering. Desire position with Oil Company in California. Age 41. Family. Box G-143, The Oil and Gas Journal, Tulsa, Oklahoma.

REWARD OFFERED

STOLEN!!! New christmas tree valve from Central Pennsylvania. 10,000# test. Serial No. 51-52-10-1044. Manufactured by Oil Center Tool Company. $500.00 reward information. Box G-124, The Oil and Gas Journal, Tulsa, Oklahoma.

TRAVEL SERVICE

TRAVEL EUROPE 60 days 1953 July and August through 7 countries in pleasant carefree way with congenial group and extensively traveled writer. Colorful memorable trip assured. Comfortable discriminating sightseeing under expert guidance. Leading hotels. Personal attention to all details. $1500 all-expense. Box G-155, The Oil and Gas Journal, Tulsa, Oklahoma.

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NEED $50,000.00 to develop potential proven shallow field (6,500 acres) lease. Will take as part investment 36-L Bucyrus with tools from 13 to 5, or similar cable tool equipment. Investor will participate from refinery profits. Write: M. A. NOGUERA, Aguiar 374 St. Havana, Cuba.

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Payment of capital gains tax today, nets you an amount almost comparable to your ultimate net realization (after taxes and depletion).

If you should consider selling—**WE WANT TO BUY**, as cost depletion will give us an entirely different tax basis. We are reliable and financially responsible producers. Bank references will be readily furnished. **We are not brokers.**

Also interested in drilling proposals with geological merit. We are not interested in Conversation, we want to buy or drill. Please submit your proposals and they will be given courteous, prompt and business-like attention. All inquiries will be held in strictest confidence.

BOX G-109, THE OIL AND GAS JOURNAL, TULSA, OKLAHOMA

ROYALTIES

WILLISTON BASIN ROYALTIES
Dealers in Montana royalties since 1921, we now specialize in royalties under major company leases in the Montana portion of the Williston Basin. For information on our method of operation, write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Montana.

JACK EAGLE—Pay you immediately for your producing royalties and Overrides, absolutely no delay, send complete details 706 City Nat'l Bldg., Okla. City, Okla. REgent 6-7027.

PRODUCTION
We Will Buy
PRODUCING landowners royalty and producing leases. Any amount, any area. Confidential information required and furnished. A 1 Bank Reference.

COMBEST ROYALTY COMPANY
825-826 Amarillo Bldg.
Amarillo, Texas

LEASE AND DRILLING BLOCKS

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver Colorado.

OIL AND GAS Lease on 40 acres in 35-17-14. Less than one-half mile from well that flowed approximately 2,000 barrels per day. Two known zones about 1,300 and 1,900 ft. Price $300.00 per acre. Leonard A. Fears, Box 493, Sapulpa, Okla.

MONTANA—Newly proven oilfield, 5000 acres. Excellent seismic data. Depth 2600 to 3100. Best offer takes. K. C. Morton, Choteau, Montana.

ACREAGE: New South Dakota wildcat, good geology, title work completed, portion landowner royalty for sale. Commence first test about November 1. For full details, write Box 822, Watertown, South Dakota.

THREE STATES—WASATCH PLATEAU, Utah, discovery area, 20,000 acres on structure between huge Major and large Independent blocks. Under 5000 ft. Principals only. Also 13,200 acres, Uintah Basin, 3½ miles from Sinclair drilling. W. H. Smart, 345 Milton Ave., Salt Lake City, Utah.

NOTICE OF SALE
The trustees of Gonzales Land & Royalty Company (Unincorporated) offer for sale upon sealed bids to be opened on November 14, 1952, at its office in Gonzales, Texas, all of its assets in bulk, including a large number of producing and non-producing mineral and royalty interests. More detailed information will be furnished upon request directed to Box 237, Gonzales, Texas. The trustees expressly reserve the right to reject any and all bids. Boyce Penrod, Office Manager.

LEASES ROYALTIES
Producing and Nonproducing
Bought and Sold—Any Area
Inquiries Invited

B. D. BUCKLEY
6235 Delmar Ave., St. Louis 5, Mo.

PRODUCTION WANTED

LEASE AND DRILLING BLOCKS

FOR SALE: Approximately 300 bbl. production per day, with a potential of several times as much. It has a dozen different pays, favorable for flooding. Also drilling, cleaning, and servicing machines, trucks and tools. Must be a bonafide company, no broker. Major Company, preferred. Box G-158, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE, BARGAIN: 69 acres, 10 year lease Shelby County, Texas, surrounded by major companies, $3.50 per acre. C. A. Parker, Center, Texas.

LEASE 1,500 acres, Vermillion Basin. Early filled Pleistocene Valley. Adjoining block to be drilled soon. Near Platte Pipe Line. $2.00 acre with 1/16 override. H. T. Harper, Vermillion, Kansas.

PRODUCTION WANTED

OIL PRODUCTION
WANTED—ANY AMOUNT—ANY AREA
Full details required. Must stand Engineering investigation. CONFIDENTIAL.

TAXMAN OIL COMPANY
414 Finance Bldg. Kansas City 6, Mo.

REAL ESTATE

OFFICES for rent to responsible company operating in Denver-Julesburg Basin. Excellent location. William B. Paynter, Brush, Colorado.

BEAUTIFUL
NEW MEXICO CATTLE RANCH
and Hunting Lodge

1. In the heart of the National Forest, 26 sections, runs 200 head grown stock, 2 streams, several springs and tanks. All kinds of big game hunting. New, beautiful, modern ranch dwelling, partly furnished. $135,000, including 95 head of cattle, 6 riding horses and all ranch equipment.

2. 30 sections, Gila National Forest. Large modern dwelling plus foreman's dwelling. Two rivers, five springs, runs 200 head mother cows. Big game hunting, bear, deer, elk, bobcat, wild turkey, etc. $85,000 without cattle, but including six Palomino riding horses, large quantity of ranch equipment, dwellings well furnished.

SHELL REAL ESTATE AGENCY
P. O. Box 1127
Silver City, New Mexico

LEGAL

Sealed bids for Oil and Gas Mining Leases on restricted Tribal and Allotted lands of the Fort Berthold Indian Reservation, North Dakota, will be received at the Office of the Superintendent of the said reservation, Elbowoods, North Dakota, until 2:00 P. M. **Central Standard Time** on November 17, 1952, and will be opened immediately thereafter in the presence of such bidders as may attend. This sale will be conducted under regulations as amended and promulgated by the Secretary of the Interior, 25 CFR 189 (Act of March 3, 1909, 35 Stat. 781, 783; 25 U.S.C. 396) governing the leasing of Allotted lands and 25 CFR 186 (Act of May 11, 1938, 52 Stat. 347; 25 U.S.C. 396 a-f) governing the leasing of Tribal land. All bids shall be enclosed in an envelope addressed to the Superintendent and plainly marked "Bid for Oil and Gas Mining Leases" to be opened at 2:00 P.M., November 17, 1952. The list includes 160 acres of Tribal land and 29,995.95 acres of Allotted lands or a grand total of 30,155.95 acres of land. This list comprises 125 separate tracts of land each tract is considered as a separate bid. The lands are located in Dunn, Mountrail and McLean Counties, North Dakota. For further information such as a complete description of the lands offered, call or write the Superintendent of the Fort Berthold Agency, Elbowoods, North Dakota. Dated October 17, 1952.

Natural-Gas Problems

(Continued from page 173)

Merriam's directorship gives Northern first call on this company's gas.

Furthermore, Calgary & Edmonton is connected with Western Pipe Lines, Ltd., which proposes to build a gas transmission line from Pincher Creek field eastward across southern Alberta, Saskatchewan, and Manitobia to Winnipeg, tapping many gas-producing areas. More than a year ago Northern made a contract with Western to purchase 200,000,000 cu. ft. of gas per day at Winnipeg which it proposed to take to the Minneapolis-St. Paul area by a line crossing the international border at Emerson, Man., close to the North Dakota-Minnesota boundary. Western's project is dormant at the moment, pending approval by Canadian authorities.

Hope for a change . . . The hope that FPC may change its policies toward company-owned gas reserves may seem faint in view of the treatment that Northern and other pipe lines have been getting recently, but there are some reasons to expect a turn-about in policy. There is always a chance that Congress will amend the law, despite two presidential vetos of legislation of this nature.

More significant, some members of the commission are publicly stating that FPC must change its rate-making policies and must treat company-produced gas the same as purchased gas. Supreme Court decisions apparently leave the way open for the commission to do this without new legislation, if it can be persuaded to do so.

It is a demonstrable fact that present FPC policies discourage the incentive to explore for and produce gas by pipe-line companies.

In 1940 the eight major interstate gas transmission lines then operating produced 47 per cent of the gas they transported, ranging from 9.4 per cent for Northern Natural to 100 per cent for Colorado Interstate Gas Co. In 1951 these same companies produced only 30.1 per cent of their gas, although Northern had increased its percentage to 19.8.

Every new large system built during the past 10 years has relied almost entirely on purchased gas, demonstrating the extent to which FPC policies encourage divorcement of production from transportation.

Serious students of the gas industry point to many advantages and economies in a transmission company owning a considerable portion of its reserves, and say it is in the public interest to encourage this.

Consumers would not necessarily be injured by such an increase in price, it has been pointed out, because only 17 per cent of the consumer's bill is for the cost of the gas itself.

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Bank of Toronto, The 164
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Blaw-Knox Construction Company 38
Broderick & Bascom Rope Co. Back Cover
Bucyrus-Erie Co. 143
Cable Engineering 163
Cameron Iron Works, Inc. 19
Century Electric Company 39
Charlie's Machine Works 151
Chicago Bridge & Iron Company Inside Back Cover
Chicago Metal Hose Division Flexonics Corporation 45
Classified Advertising 177, 178, 179, 180
Cleveland Worm & Gear Company, The 26
Continental Oil Co. 20
Crose Manufacturing Co., Inc., M. J. 137
Crossley-Premier Engines, Ltd. 156
Darling Valve and Mfg. Co. 159
Dean Brothers Pumps, Inc. 165
Dean Hill Pump Company 47
De Laval Steam Turbine Co. 14
Delta Engineering Sales Co. 148
Diamond Alkali Company 13
Diamond Chain Company, Inc. 152
Dowell Incorporated 62
Dresser Industries, Inc. 52, 138
Dresser Manufacturing Division 130
Drilling & Service, Inc. 166
du Pont 3
Elliott Company 44
Empire Trust Company 155
Fairbanks, Morse & Co. 2
Fluid Packed Pump Company 117, 118
Foxboro Company, The 135
General American Transportation Corporation 81
General Descaling Co., Ltd. 149
General Electric Co., Electronics Dept. 48
Goodyear Tire & Rubber Company 9
Gott Mfg. Co., H. P. 156
Grancell, I. H. 150
Griscom-Russell Co., The 46
Guiberson Corporation 7
Halliburton Oil Well Cementing Co. 17
Harley Sales Co. 53
Harrisburg Steel Corporation 139
Helicoid Gage Division, American Chain & Cable Co. 112
Hercules Tool Company 115
Hobbs Manufacturing Company 110
Houston Contracting Company 144
Huey & Co., S. E. 145
Hughes Tool Co. Front Cover
Hydril Company 130
Inferno Co., The 151, 163
International Harvester Co. 82
Jones & Laughlin Supply Co. 31
Kerotest Manufacturing Co. 50
Koppers Company, Inc. 41
Lane-Wells Company 60
Larkin Packer Company, Inc. 78
Lloyd Metal Foundry Co. 144
Lonergan Co., J. E. 145
Magnet Cove Barium Corp. 52
Manning, Maxwell & Moore, Inc. 18
Mayo Hotel, The 149
McCord Corporation 149
Mercantile National Bank 10
Metal Goods Corporation 27
Midwest Piping & Supply Co., Inc. 16
Minneapolis-Honeywell Regulator Co., Industrial Division 49
Mission Mfg. Company 57
Monsanto Chemical Company 34
Moore Corporation, Lee C. 134
Murdock Tank & Mfg. Co. 163
National Airoil Burner Co., The 149
Nordstrom Valve Division, Rockwell Manufacturing Company 36, 37
Norris Brothers, Inc. 145
Oil and Gas Journal, The 165
Onan & Sons, Inc., D. W. 162
Paris Distributor, Inc., Henry H. 155
Penn Controls, Inc. 160
Perrault Brothers 145, 163
Petroleum Distributing Co. 160
Petroleum Electric Power Assn. 21
Reda Pump Company 160
Reed Roller Bit Company 113
Republic Steel Corporation 29
Ridge Tool Company, The 124
Roebling's Sons Company, John A. 30
Ryerson & Son, Inc., Joseph T. 142
Smith Corporation, A. O. 134
Socony-Vacuum Oil Co., Inc. 49
Standco Brake Lining Co. 151
Steel Forgings, Inc. 145
Stewart & Stevenson, Inc. 146
Taylor Chain Co., S. G. 158
Templeton, Kenly & Co. 151
Thomas Flexible Coupling Co. 56
Thurmon Investment & Realty Co. 167
Triangle Conduit & Cable Co., Inc. 55
Tulsa Engineering Sales Company 165
Turner Uni-Drive Company 54
Twin Disc Clutch Co. 55
United States Gasket Company 114
U. S. Gypsum Co. 122
United Supply & Manufacturing Co. 128
Vogt Machine Co., Henry 51
Walworth Co. 5
Warner Lewis Company 167
Waterman Machine & Manufacturing Co. 145
Well Equipment Mfg. Corp. 116
Wickes Boiler Co., The 141
Williamson, Inc., T. D. 162
Wilson Manufacturing Co., Inc. 29
Wolverine Tube Division, Calumet and Hecla Consolidated Copper Company, Inc. 12
Worthington Corporation 22
Wyatt Metal & Boiler Works Inside Front Cover

LEGAL

U.S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D.C. Notice is hereby given that 320 acres of land in T. 35 N., R. 84 W., 6th P.M., Wyoming, within the known geologic structure of the Pine Mountain field, will be offered in three parcels for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 1 p.m., Eastern Standard Time, November 12, 1952, when bids will be opened. Details of the lease offering, how and where to file bids, and a description of the lands may be obtained by addressing an inquiry to the Manager of the Land and Survey Office, Cheyenne, Wyoming, or to this office. Marion Clawson, Director.

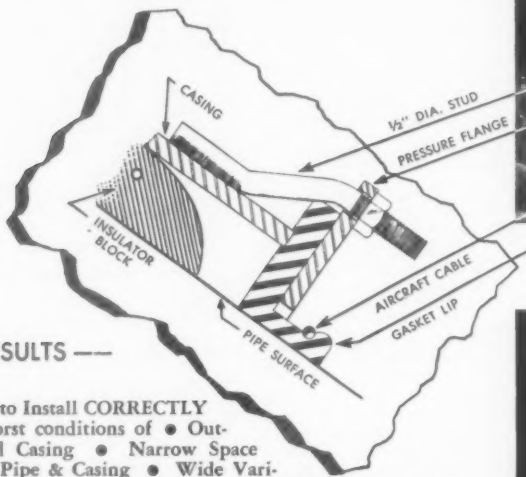
LEGAL

U. S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT, Washington 25, D. C. Notice is hereby given that 18 parcels of land in Tps. 10 N., R. 58 E.; 8 N., R. 59 E.; 5, 6 and 7 N., R. 60 E.; and 5 and 6 N., R. 61 E., P.M., Montana, containing approximately 5,770.58 acres, within the known geologic structure of the Cedar Creek field, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1 p.m., Eastern Standard Time, November 19, 1952, when bids will be opened. Approximately 2,400 acres of the lands offered are subject to existing compensatory royalty agreements covering the natural gas deposits of the Judith River sand and are within areas of and subject to existing unit agreements. Special stipulations will be inserted in any leases issued for these lands. Details of the lease offering and the special stipulations and how and where to file bids may be obtained by addressing an inquiry to the Manager of the Land and Survey Office, Billings, Montana, or to this office. Marion Clawson, Director.

PIPE-LINE TESTED, PROVED and ACCEPTED in '51

TYPE "L" WmSEAL CASING BUSHING*

A New Design: It BUTTS Against End of Casing Instead of Fitting Inside the Casing.



Assembling cable with rubber-covered union for clamping gasket lip to pipe.

RESULTS —

1. Easier to Install CORRECTLY under worst conditions of • Out-Of-Round Casing • Narrow Space Between Pipe & Casing • Wide Variations in Casing Wall and Coating Thickness • Mud • Casing ends beveled — by machine or hand torch.
2. WATER-TIGHT Seal with "L" gasket . . . . . .
   - BUTTED AGAINST CASING as pressure flange is tightened on ½" studs welded to casing.
   - TIGHT TO THE PIPE as aircraft cable (4,600# tensile) is tightened to gasket lip. Union is rubber covered to INSULATE galvanized cable assembly from bare casing structure.
3. Always Insulated from the pipe line when a Concentric-Support Insulator is installed just inside casing after the "drag section" is in place.

THE COMPLETED INSTALLATION
Note that galvanized cable and union are insulated from pressure flange and from pipe.

AS STRONG & DEPENDABLE AS THE MEN WHO INSTALL THEM

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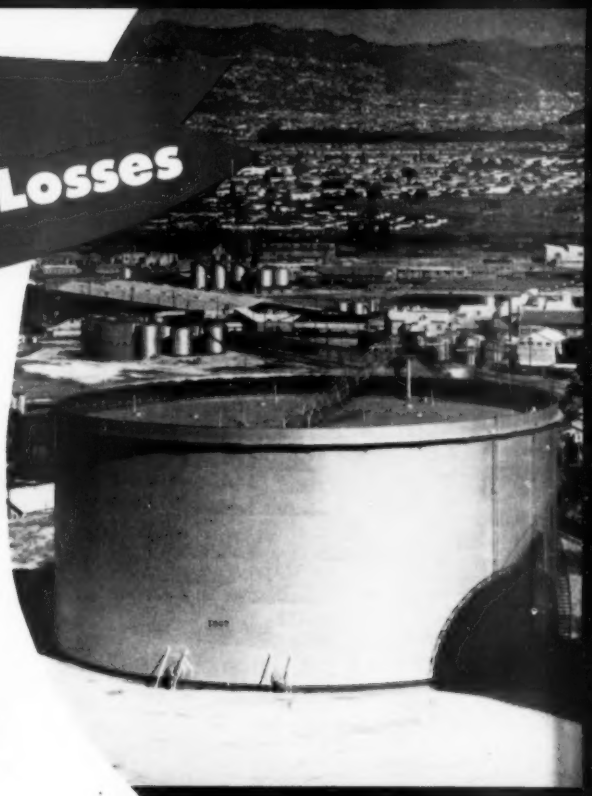
*Patent Pending

WRITE FOR BULLETIN 249A

T. D. Williamson, Inc.
TULSA 9, OKLAHOMA

8,000 Pipe Line Casings installed in 1951 with Williamson Bushings and Insulators

Reducing Evaporation Losses with HORTON Floating Roofs



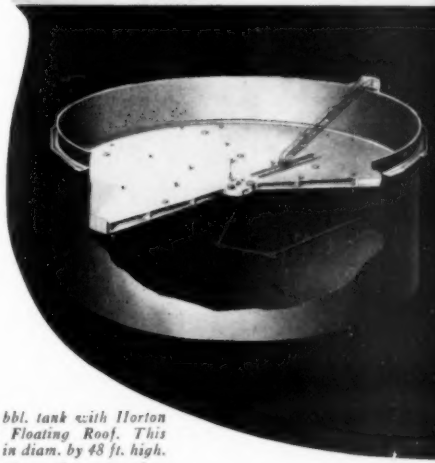
Efficient storage and handling of crude oil, gasoline and similar volatile liquids require the use of modern storage equipment. Storing volatile hydrocarbons in fixed-roof tanks can be very costly. Filling and emptying of the tanks and thermal expansion and contraction of the air-vapor mixture above the liquid causes large evaporation losses.

Modern storage tanks equipped with Horton Floating Roofs are reducing evaporation losses, corrosion and fire hazard. Floating directly on the surface, the entire bottom of the roof is normally in contact with the liquid in the tank. There is no air-vapor mixture above the liquid to be vented and lost. Fire hazard and corrosion are also reduced as a result of the elimination of this vapor space.

Horton Floating Roofs are built in three types: (1) The Double-Deck Floating Roof which has a double deck over the entire surface of the liquid being stored. (2) The Pontoon Floating Roof with an annular pontoon and a center section of single thickness. (3) The Pan Floating Roof which has a deck of single thickness over the entire liquid surface.

Assuring the utmost in efficiency from these three types of floating roof is the Horton Seal, a device which efficiently closes the space between the rim of the roof and the tank shell. The Horton Seal is standard equipment on all Horton Floating Roofs.

Let us help you select the roof most suitable for your operation. Write our nearest office for further information or quotations.



Top: 67,000 bbl. tank with Horton Double-Deck Floating Roof. This tank is 100 ft. in diam. by 48 ft. high.

Bottom view: Cutaway view showing construction of Horton Double-Deck Floating Roof.

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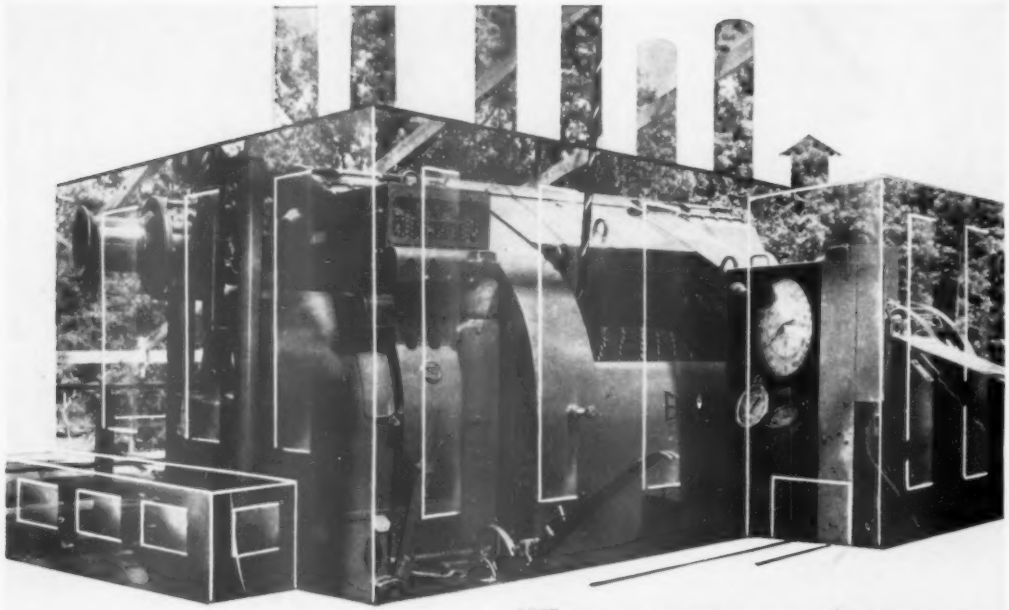

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When *reserve power* is needed, will your wire rope come through?

Soft jobs are scarce. More and more you figure on pushing equipment to capacity, and to succeed you need wire rope with stamina to match. That's why we engineer a powerful reserve of strength and toughness into Preformed Yellow Strand. Whenever abnormal demands are caused by speed, shock, vibration or fatigue, the rope automatically works to minimize the effects and to forestall shutdowns. The exact rope construction for your application will be recommended by an engineer who is quick to grasp individual problems. How about getting together now?

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